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REVIEW
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APPLIED ENTOMOLOGY.

SERIES A.

Vol. 38. 1950.

LEJEUNE (R. R.) & FILUK (B.). **The Effect of Water Levels on Larch Sawfly Populations.**—*Canad. Ent.* **79** (1947) no. 9–10 pp. 155–160, 3 refs. Guelph, Ont., 1948.

In western Canada, the larch sawfly [*Pristiphora erichsonii*, Htg.] spends nine or ten months of the year in cocoons in the soil, and the ground water directly affects its development and also regulates its predators and, possibly, parasites [*cf. R.A.E.*, A **37** 442]. Studies on the influence of ground water on its survival were begun in the autumn of 1946, when cocoons were placed in moss kept continuously submerged in water, submerged for limited periods only, or just moistened with sufficient water to prevent desiccation. Similar cocoons were installed above and below the water-line in larch swamps, and some observations were also made on cocoons collected above and below the water level under natural conditions in the field. The effect of the treatment was determined by dissection, supplemented where necessary by rearing, performed as far as weather conditions permitted at monthly intervals until the following September.

It is concluded from the experimental results that larvae in cocoons are resistant to submergence during the autumn, but that if it is continued during the winter, all are destroyed by the following spring. The larvae appeared to be most susceptible to submergence during spring and summer at the periods when they would normally be undergoing metamorphosis, probably as a result of their high oxygen requirements at that time. Continuous submergence caused complete mortality, but such conditions are infrequent in the field and would be undesirable from the standpoint of tree growth. Survival was highest among cocoons kept in moist moss, where the conditions were similar to those in well-drained larch stands. The evidence suggests that the chances of survival are appreciably improved as the experimental conditions approach natural field conditions.

These results are somewhat at variance with records kept at Winnipeg, which show that the degree of defoliation is, on the whole, lowest in dry situations, though higher in moist than in wet ones. Some discrepancies may be due to faulty classification of moist sites as wet ones or to changes in water level between the time of metamorphosis and later in the season, when defoliation is recorded.

(1787) Wt. P18/3825 2/50 S.E.R. Ltd. Gp. 432. [Al A

Brown (A. W. A.), Hopewell (W. W.), Wenner (B. J.) & McDonald (H.). **Laboratory Assessment of organic Insecticides for Control of certain Lepidopterous Larvae.**—*Canad. Ent.* **79** (1947) no. 9–10 pp. 161–166, 9 refs. Guelph, Ont., 1948.

The results are given of comparative tests in Canada of the contact toxicity to late-instar larvae of *Agrotis orthogonia*, Morr., *Heliothis ononis*, Schiff., or *Choristoneura* (*Cacoecia*) *fumiferana*, Clem., of 15 organic insecticides applied at 75–80°F. and over 75 per cent. relative humidity in a spray tower at concentrations of 0·0005–8 per cent. in a mixture of benzene and kerosene (4 : 1) to give a deposit of 4 cu. mm. spray per sq. cm. All the compounds were used in as pure a form as possible. The spray droplets varied from 5 to 90μ in diameter, with a mass median diameter of approximately 60μ. The larvae were collected in the field and transferred to optimum conditions for feeding after treatment ; mortality counts were made four days later.

The most toxic compounds and (in brackets) the doses in mmg. per sq. cm. required for 50 and 90 per cent. mortality were γBHC (γ isomer of benzene hexachloride) (5·5 and 12), DNC (dinitro-o-cresol) (7·5 and 12), pyrethrins (8·2 and 13) and chlordan (18 and 60) for *Agrotis*, pyrethrins (4 and 14), DDT (7 and 80), DNC (16 and 38) and γ BHC (23 and 80) for *Heliothis*, and pyrethrins (0·05 and 0·1), DDT (0·3 and 2·7), γ BHC (1·9 and 6·7) and DNC (4 and 19) for *Choristoneura*. The two lethal doses of DDT for *Agrotis* were 80 and 115 mmg. ; the median lethal dose of chlordan for *Choristoneura* was 140 mmg. and it was still less toxic to *Heliothis*. The other less effective compounds were methoxy-DDT (75 and 250 mmg. against *Agrotis*), nicotine (42 and 160 against *Choristoneura*), toxaphene (28 and 50 against *Agrotis*), rotenone, dinitro-o-cyclohexylphenol, two thiocyanate preparations (lethane 60 and 384), thanite, azobenzene and hexaethyl tetraphosphate containing a substantial proportion of tetraethyl pyrophosphate.

On the basis of weight of active compound in the spray, pyrethrins were the most generally toxic of the materials tested, but they lack persistence in the field, and highly concentrated solutions are costly and difficult to obtain. In view of the volatility of BHC deposits, this material was not sufficiently more toxic than DDT to be preferable for use against *Choristoneura* or *Heliothis*, but it may be of some value against *Agrotis*. DNC, which was highly toxic to all three species, is cheap and rapid in action, but deposits exceeding 5 lb. per acre are liable to scorch foliage, and its persistent effect [*cf. R.A.E.*, A **35** 407] is not great.

Johansson (W. I.), Rosene (L.) & Warner (C. N.). **The Effects of a miscible Oil, a Di-nitrol Compound, and D.D.T. Emulsion upon the Egg Masses of the Eastern Tent Caterpillar** *Malacosoma americana* **L.**—*Canad. Ent.* **79** (1947) no. 9–10 pp. 166–167. Guelph, Ont., 1948.

In the laboratory tests described, overwintering egg-masses of *Malacosoma americana*, F., were sprayed with 4 per cent. miscible oil, a 2 per cent. solution of an unspecified dinitro compound, and an emulsion concentrate containing 25 per cent. DDT diluted 1 : 1,600 and 1 : 800. Of 311 larvae that hatched from two egg-masses sprayed with miscible oil, 305 were still alive when examined 90 hours later, but none of 218 from two masses sprayed with DDT at the lower concentration or 172 from two sprayed with the dinitro compound had survived. Only 87 larvae hatched from three egg-masses sprayed with the higher concentration of DDT, but 22 were still alive after 90 hours. There was no mortality among the 439 larvae that hatched from three unsprayed egg-masses.

HICKS (S. D.). *Brachyrhinus raucus* (**Fab.**), **an European Weevil new to North America.**—*Canad. Ent.* **79** (1947) no. 9–10 p. 171. Guelph, Ont., 1948.

An example of *Otiorrhynchus* (*Brachyrrhinus*) *raucus*, F., which has not previously been recorded from America, was found in a nursery in south-eastern Ontario in May, 1936. Two others were taken in different parts of eastern Ontario in 1937 and 1943, and it is concluded that this European weevil is established in that Province.

ARNASON (A. P.), FOX (W. B.) & GLEN (R.). **A preliminary Test of DDT and Benzene Hexachloride for the Control of Wireworms in a Saskatchewan Potato Field.**—*Canad. Ent.* **79** (1947) no. 9–10 pp. 174–180, 7 refs. Guelph, Ont., 1948.

The control methods recommended against wireworms in the Prairie Provinces of Canada comprise cultural measures, which provide adequate protection only for cereal crops, and the use of crude naphthalene [*R.A.E.*, A **25** 123], which is costly, difficult to apply, and effective only under certain conditions, so that commercial potato production is largely restricted to areas and fields from which wireworms are virtually absent. In an attempt to develop a more satisfactory method, treatment of the soil or seed pieces with DDT or BHC (benzene hexachloride) was investigated in Saskatchewan in 1945–46. The tests were carried out in a field on silty loam where wireworms, especially *Ctenicera* (*Corymbites*) *aeripennis destructor*, Brown, had been very injurious to potatoes for several years. In the soil treatment, DDT was applied on 23rd April 1945 at rates of 20 and 100 lb. per acre diluted in soil and a BHC powder containing 20 per cent. crude BHC (equivalent to 2·5 per cent. γ isomer) on 25th May at 25 lb. per acre in talc ; the insecticides were ploughed or dug into the soil to a depth of 7–8 ins. The seed tubers were treated by being shaken in a paper bag with a little of the BHC powder or a 20 per cent. DDT powder. In all the plots, the tubers were planted on 25th May and lifted in the first half of October, when yield and damage records were taken. In the case of the soil treatments, counts of wireworms were made then and in the following June ; all those found were *C. a. destructor* except for one larva of *Hypolithus nocturnus*, Esch., and one adult of *Aeolus mellillus mellillus*, Say.

In the soil treatments, the percentage reductions in wireworm populations in October, as compared with the controls, and (in brackets) the percentages of uninjured marketable tubers, as compared with 11 per cent. in the controls, were 89 (76) for BHC, 63 (32) for 100 lb. DDT and 23 (15) for 20 lb. DDT, and larvae were still being affected by the insecticides ; the average numbers of tunnels per tuber were 0·3, 1·9 and 3·8, respectively, with 4·2 in the controls. Had the BHC been applied as early as the DDT, the results with it might have been still better. Adults were not found in the BHC plot, but were as numerous in the DDT plots as in the controls. The percentage reductions in larval populations in June 1946 were 93, 76 and 23 ; the numbers still surviving the BHC treatment were not sufficient to cause more than light damage to potatoes, but those surviving DDT would have caused considerable injury. BHC affected the flavour of the cooked potatoes, and tests in other places indicated that the tainting persists even in tubers grown in soil treated in the previous year.

In the seed-piece treatments, BHC severely reduced and delayed sprouting, and neither material afforded satisfactory protection to the crop.

The soil treatment with BHC is considered promising for the Prairie Provinces, and unpublished records indicate that it is effective under nearly all the conditions of soil, humidity and temperature found in crop land. Because of the danger of tainting, it should be applied 2–3 years before potatoes are planted, and a crop rotation including summer fallow or cereals or other crops

not susceptible to tainting is suggested to cover the interval. Experience indicates that once the wireworms are eliminated in a field, they will not increase in three years sufficiently to cause serious damage. Applications should be at the rate of 0·5–1 lb. γ isomer per acre in April or May, and can be made by various types of farm machinery.

MONRO (H. A. U.). **The Durra Stem Borer** *Sesamia cretica* **Led. A new Problem in imported European Broom Corn.**—*Canad. Ent.* **79** (1947) no. 9–10 pp. 180–190, 5 figs., 22 refs. Guelph, Ont., 1948.

The following is almost entirely the author's summary. Consignments of broom corn imported from Italy into Canada in 1947 were found to be infested by larvae of *Sesamia cretica*, Led., which is an important pest of maize and sorghum in and near the Mediterranean region, but does not occur on the American continent. A review of the literature concerning it indicates that although larvae are reported as succumbing to low temperatures in the region of 17°F. [*R.A.E.*, A **23** 521], there are no reliable data on the length of exposure required to kill them. There is thus no justification for assuming that the species could not become either permanently established in some parts of Canada or cause temporary outbreaks that might involve a danger of its introduction into the maize- and sugar-growing areas of the southern United States.

It was found that living larvae of *S. cretica* and *Pyrausta nubilalis*, Hb., inside the stalks of broom corn could be destroyed in approved types of Canadian steel railroad cars of 3,712 cu. ft. capacity, when bale temperatures were as low as 32°F., by employing 9 lb. methyl bromide per 1,000 cu. ft. with exposure periods of 48 hours, with loads of 200 bales weighing approximately 10 short tons [*cf.* **35** 29, 267]. A condition of delayed mortality of fumigated hibernating larvae of *S. cretica* is described, in which one individual survived for as long as 140 days following exposure to the fumigant.

DIONNE (L. A.). **Field Identification of Potato Aphids.**—*Canad. Ent.* **79** (1947) no. 9–10 pp. 191–193, 2 figs. Guelph, Ont., 1948.

A key is given for the rapid identification of the wingless forms of *Myzus persicae*, Sulz., *Macrosiphum solani*, Kalt. (*Myzus pseudosolani*, Theo.), *Macrosiphum solanifolii*, Ashm., and *Aphis rhamni*, Boy. (*abbreviata*, Patch), the four Aphids of importance on potato in eastern Canada. It is based on characters visible to the naked eye or through a hand lens, and was successfully used in 1947 by potato inspectors in New Brunswick and Nova Scotia in determining potential populations of leaf-roll vectors.

WELLINGTON (W. G.) & HENSON (W. R.). **Notes on the Effects of physical Factors on the Spruce Budworm,** *Choristoneura fumiferana* **(Clem.).**—*Canad. Ent.* **79** (1947) nos. 9–10, 11–12 pp. 168–170, 195, 4 refs. Guelph, Ont., 1948–49.

Studies in Ontario in 1946–47 on the effect of weather factors on the behaviour of the spruce budworm, *Choristoneura fumiferana*, Clem., showed that the newly hatched larvae are attracted to light and congregate at the tips of the needles on which they hatch, where overcrowding causes many to drop on silken threads. These fall to lower twigs or are dispersed by means of convection currents, when they may reach another tree ; in either case, their phototropic behaviour again takes them to the periphery of the tree. When they are shielded from direct sunlight by cloud, they continue to be attracted to light until they come into contact with objects that provide shelter, such as lichen or the scars left by staminate flowers, in which they spin their hibernacula.

On clear days, however, larvae approaching the periphery of the tree may be warmed by radiant heat to a temperature of over 84°F., at which their phototropic reaction is reversed, causing them to return to the shade, where contact with débris likewise induces the construction of hibernacula. Larvae that hatch on overcast days may in consequence construct their hibernacula in situations where they may later be exposed to desiccation. Feeding does not begin until the larvae have moulted, overwintered and emerged from the hibernacula in spring. They are then strongly phototropic and migrate to the edge of the tree, where is the most suitable food. They are dispersed by means of silken threads over a wider area than the first-instar larvae, because the weather is rougher at the season when they are active. Low air temperatures are common at this time, and feeding appears to cease at temperatures below 50°F. if the sky is overcast, but not under broken cloud or clear skies, when direct isolation warms foliage enclosing the larvae. In the laboratory, larvae in all instars became sluggish under saturated air conditions, and the older ones were observed to cease feeding during light or moderate rain in the field. The young larvae, however, feed within the needles or tightly packed buds, where moisture conditions approach saturation, and it is suggested that some compensating factor, such as a high oxygen content, must be present within the needles and buds, or that the jaw movements of young larvae are not influenced by low evaporation. Larvae in the last three instars are positively phototropic, when fully fed, but become negatively phototropic to any type of light if sufficiently heated (to about 100°F. in the case of the last instar) or to light from a discrete source (such as the visible disk of the sun) as a result of some effect of progressive starvation. Either type of negative phototropism causes them to drop to lower parts of the tree or to the ground, and last-instar larvae also drop when stimulated by vibration due to strong winds or by flooding of the tunnels by rain.

Fully gravid females are unable to fly until they have deposited one or two egg-masses and are therefore likely to deposit their first eggs on the tree on which they emerge. Adults of both sexes are dispersed by air currents. The males rapidly become adapted to any light intensity and are positively phototropic when adapted to the dark. Both sexes are inactive to light. Dark-adapted females are either negatively phototropic or show a compassing behaviour ; there is no evidence of orderly transition between the two. As a result of the light-compass orientation, flying females may be caught in light-traps.

LORD (F. T.). **The Influence of Spray Programs on the Fauna of Apple Orchards in Nova Scotia : II. Oystershell Scale** *Lepidosaphes ulmi* **(L.).**—*Canad. Ent.* **79** (1947) no. 11–12 pp. 196–209, 1 fig., 8 refs. Guelph, Ont., 1949.

This part of a series dealing with a long-term investigation of the effects of sprays on the Arthropod fauna of apple orchards in Nova Scotia [*R.A.E.*, A **36** 270] is devoted to observations on *Lepidosaphes ulmi*, L., and its natural enemies in experimental and commercial orchards sprayed with fungicides for the control of apple scab (*Venturia inaequalis*). The results in the commercial orchards confirmed those in the experimental orchards, which have been noticed from another source [**36** 392].

The paper also includes notes on the history of spray practices in Nova Scotia, with special reference to *L. ulmi*, and on the bionomics of this Coccid and of its parasite, *Aphytis* (*Aphelinus*) *mytilaspidis*, LeB., and the predacious mite, *Hemisarcoptes malus*, Shimer. The bionomics of the first two in general resemble those in New York [**13** 569]. *L. ulmi* has one generation a year. The females that develop from the overwintered eggs each deposit about 30 eggs which hatch during the first three weeks of June. The second instar is reached about

the end of June, the second moult occurs during August, and oviposition continues from about the middle of August into September. Adults of the overwintered generation of *A. mytilaspidis* emerge about the first week in July and oviposit in the second-instar Coccids. First-generation adults emerge early in August and oviposit in the adult Coccids, and second-generation adults emerge during September and are present throughout most of the month. The third-generation larvae overwinter under the scales. *H. malus*, which attacks all stages of the Coccid, overwinters mostly in the later immature stages. Gravid females are found in late May and June under the scales, where they oviposit. The eggs hatch at about the same time as those of the Coccid, and many of the protonymphs attach themselves to the crawlers before the latter migrate. Eggs of the mite occur throughout the season, but are most abundant under the old scales in June and under the ovipositing Coccids. The mite is most effective when *L. ulmi* is abundant.

H. malus and *A. mytilaspidis* are the principal agents of natural control of *L. ulmi* in Nova Scotia, and either can apparently check a heavy outbreak. If the mite becomes established first, it exerts outstanding control of a heavy infestation in a year, but the parasite has not shown itself able to do this. The mite is usually very scarce in the year after it has exerted control, however, whereas parasitism of 10–50 per cent. is common. The only other parasite of *L. ulmi* observed was *Chiloneurinus microphagus*, Mayr, which was of no apparent significance. There was no evidence that other predators or low temperatures or other unfavourable weather conditions caused any substantial or regular reduction of the Coccid.

Incidental observations were made on the effect of some common orchard insecticides on the natural control of *L. ulmi*. Sprays of lead arsenate, synthetic cryolite and nicotine sulphate were harmless to the parasites and mites. DDT at 1 lb. per 100 gals. gave such high mortality of first-instar Coccids that its effect on natural enemies could not be observed, but when it was used at ¼–½ lb. per 100 gals., the Coccids that it did not kill were all destroyed by *H. malus*. Dormant oil killed the overwintering parasite larvae and also, in the laboratory, the mites under the scales, dinitro-o-cresol in dormant oil killed the parasite larvae and its sodium salt in the laboratory killed both the parasite and the mites under the dormant scales, summer oil had little effect on either the Coccid or the mite, and a thiocyanate preparation (Lethane B 72) was ineffective against the Coccid, but very toxic to the mite.

DUSTAN (G. G.) & PUTMAN (W. L.). **Particle Size of DDT wettable Powders in Relation to Toxicity.**—*Canad. Ent.* **79** (1947) no. 11–12 pp. 216–221, 1 fig., 4 refs. Guelph, Ont., 1949.

The relative toxicity of three wettable spray powders that contained 50 per cent. DDT, but differed in average particle size as a result of the processing methods involved, was tested in the laboratory and greenhouse in Ontario. They comprised micronised, finely pulverised (hammer-milled) and coarsely pulverised powders with average mean particle diameters of about 5, 15 and 25μ, respectively. The methods adopted comprised spraying adults of *Oncopeltus fasciatus*, Dall., and nymphs of *Empoasca fabae*, Harr., and transferring them to unsprayed plants; placing nymphs of *E. fabae* on sprayed detached portions of plants; infesting small chrysanthemum plants with *Rhopalosiphum rufomaculatum*, Wilson, and applying the spray to both; and placing unsprayed larvae of *Plutella maculipennis*, Curt., and unsprayed eggs of *Cydia* (*Carpocapsa*) *pomonella*, L., due to hatch in 24 hours on sprayed foliage and apple fruits, respectively. In the tests with *C. pomonella*, the effect of weathering on the deposit was tested by washing some of the fruits; extensive investigations over a period of three years showed that the persistent contact

action of the insecticide was of considerably greater importance against this insect than its stomach action.

The finest powder was the most effective [*cf. R.A.E.*, A **36** 328] in all the tests except those against *C. pomonella* on unwashed apples. The relative difference in toxicity was greater in the tests by the first method, in which direct contact action was chiefly involved, than in the others, in which persistent contact and stomach actions were concerned. The experiments are not, however, regarded as valid comparisons either of the exact particle size specified for each powder, since most of a powder in which the diameter range is wide may comprise particles differing greatly from the average, or of the micronising and hammer-milling processes, since the particle sizes produced by each may vary considerably. The deposit left by the micronised powder withstood weathering rather better than that from the finely pulverised one.

Baldwin (W. F.) & Coppel (H. C.). **Observations on the Emergence of *Phorocera hamata* A. and W. (Tachinidae) from Sawfly Cocoons.**—*Canad. Ent.* **79** (1947) no. 11–12 pp. 221–223, 1 fig., 3 refs. Guelph, Ont., 1949.

In the course of studies on the biological control of several sawflies in Canada, field-collected cocoons of *Neodiprion lecontei*, Fitch, and *N. banksianae*, Rohw., were found to be rather heavily parasitised by the Tachinid, *Phorocera hamata*, Aldr. & Webber. Experiments are described, showing that the groove forming the characteristic cap-like lid left on the host cocoon by the emerging adult parasite was formed by the action of the mouth hooks of the mature parasite larva just before pupation, confirming previous conclusions that the emergence holes formed by some Tachinids that complete their development in sawfly cocoons are prepared by the larvae [*R.A.E.*, A **21** 186].

Putnam (L. G.). **Note on the Disappearance of dead Grasshoppers from Sites of Application of Control Measures.**—*Canad. Ent.* **79** (1947) no. 11–12 pp. 225–226. Guelph, Ont., 1949.

It is common experience in grasshopper control in Canada that many of the grasshoppers found to have been killed by a particular measure are represented only by dismembered remains. It is therefore probable that many disappear altogether before inspection is made, particularly if slow-acting poisons are used, so that the effectiveness of a treatment could not be assessed merely by the numbers found dead. In order to ascertain the extent to which this occurs, dead nymphs of *Melanoplus* spp. were distributed over areas of one square yard in dry upland range land in British Columbia and on wheat stubble and weeds in Saskatchewan in the summer of 1945. After 48 hours only 11 of 193 were recovered in the first place and an average of 11 per cent. in the second, many being disintegrated. Insects that were possibly responsible were grasshoppers, *Gryllulus* (*Gryllus*) *assimilis*, F., ants, various Carabids, species of *Silpha* and *Necrophorus*, and, occasionally, *Eleodes* spp. ; small mammals and birds might also be involved. The technique adopted in these tests is recognised to be open to criticism, and recent evidence indicates that if a quick-acting insecticide is applied over a large area populated by adult grasshoppers, counts of dead individuals made within 24 hours provide useful and probably accurate information. Estimates of living populations before and after treatment can provide more accurate data, provided that the area treated is sufficiently extensive to minimise the effect of migration.

Simmonds (F. J.). **Some Factors influencing Diapause.**—*Canad. Ent.* **79** (1947) no. 11–12 pp. 226–232, 2 refs. Guelph, Ont., 1949.

As a result of work on Hymenopterous parasites, some of which has already been noticed [*R.A.E.*, A **34** 295], the author concluded that diapause in

insects is brought about by a physiological disturbance at some stage in development, and that it is therefore not an adaptive character, but a pathological state due to previous influences. It frequently coincides with unfavourable conditions because the latter initiate the physiological disturbance with which it is related, but in many species it occurs when the environment is favourable.

Since it seemed probable that the tendency for larvae to enter diapause might be influenced by an alteration in their food or by the type of development undergone by the parent female, the effect of these factors was investigated with *Cryptus inornatus*, Pratt, the ectoparasite of *Loxostege sticticalis*, L., used in the previous work, as the test insect. Females reared from field-collected larvae in diapause, from field-collected larvae not in diapause stored for eight months at 35–40°F. and from the non-diapausing progeny of the latter were allowed to pair with similar males and to oviposit in cocoons containing hibernating larvae of *Loxostege*, and the eggs were removed and placed singly on coddled host larvae [*cf.* **33** 74]. The temperature was 75°F. and the relative humidity about 70 per cent. The quantity of food consumed by the parasite during development was varied by supplying either one or two larvae of *Loxostege* and its quality by supplying individual coddled larvae of *Pyrausta nubilalis*, Hb., *Cydia pomonella*, L., or *Ephestia kuehniella*, Zell.; mortality on *Cydia* was high, so that the results had little value, and so high on *Ephestia* that use of this species was discontinued.

The results of the work, which are presented in tables and discussed, showed that the maternal influence affected the percentage of progeny that entered diapause, whatever their food. There was a tendency for those from females with a history of diapause to develop directly, and since such females deposited most eggs during the first part of their life, whereas females from non-diapausing larvae deposited most 30–40 days after emergence, it is concluded that the rate of maturation of the ovaries is accelerated by diapause. The quantity of food provided had little effect on diapause, though the development of the parasites lasted a little longer with two hosts than with one, the full-fed larvae and resulting adults were larger, and larval mortality was lower. When larvae of *Pyrausta* were used as hosts, the percentages of parasites that entered diapause and the duration of development of those that did not were both considerably increased. Mortality among parasite larvae reared on *Loxostege* and *Pyrausta* was similar, indicating that *Pyrausta* is in general a suitable host. It is suggested that the increase in diapause resulting from a change of host might be of value in the propagation of parasites for storage or shipment, where a high proportion of diapausing larvae might be an advantage. The sex ratio appeared to be unaffected by the quantity or quality of the food supplied.

HOLMES (F. O.). **The filterable Viruses.** Supplement No. 2, Bergey's Manual of determinative Bacteriology, Edition VI, 1948, with revised and enlarged Index.—9¼×6 ins., pp. [3+] 1127–1286, i–xxiii. Baltimore, Md., Williams and Wilkins Co., 1948.

The author has revised his previous classification of the viruses that infect seed plants or attack bacteria [*cf. R.A.E.*, A **29** 437] and extended the system to include viruses that cause diseases in animals. The plant viruses now comprise 16 genera in six families, and classification by symptoms and vectors (where known) is maintained. The information on the individual species has the same range as before. The viruses that cause disease in animals include a few that attack insects.

SMITH (A. C.). **Mothproofing with DDT during Drycleaning.**—*Soap & sanit. Chem.* **23** no. 5 pp. 122–125, 6 figs., 4 refs. New York, N.Y., 1947.

The author describes a recently developed method for moth-proofing clothing by impregnating it with DDT at the time of dry cleaning. The treatment is carried out after the garments have been cleaned, transferred to the extractor and centrifuged in the usual manner. A special mobile machine is then connected to the extractor, the solvent ordinarily used for cleaning is allowed to flow into the machine and through a tank containing DDT, and the resulting solution is led back to a spray head in the top of the extractor and sprayed through the load until the desired amount has been added. Centrifuging is then continued for 2–3 minutes to remove excess solution, and the material is dried in the usual way. Since the DDT solution is applied as a spray during centrifuging, it is forced uniformly through all parts of the fabrics, regardless of their thickness or form. The process prevents contamination of the regular dry-cleaning solvent and can be applied to selected loads.

Standard tests against carpet beetles [*Anthrenus*] [*cf. R.A.E.*, A **26** 227] showed that no proofing was obtained when materials were impregnated with less than 0·1 per cent. of their weight of DDT. The lowest concentration necessary to afford protection varied between 0·1 and 0·25 per cent., owing to such factors as condition of cloth (presence of textile finishing oils), type of weave and variety of fabric, but protection was complete when more than 0·25 per cent. DDT was on the cloth, and it was found advisable to apply 0·4–0·5 per cent. in the extractor. Samples treated in this manner remained free from attack for over two years. If the quantity of DDT exceeded about 0·75 per cent., the deposit was sometimes visible on dark garments. Some of the DDT was lost by vaporisation during drying, but the stability of DDT during this operation was evidenced by the fact that no decomposition products of the chemical, such as hydrochloric acid, were detected at the exhaust end of the dryer.

There was no decrease in the tensile strength of cotton, wool, silk, casein fabric, acetate rayon, cellulose rayon or Nylon after impregnation with as much as 2·4 per cent. of their weight of DDT, and the colour and colour fastness to water and light of red, yellow, blue, brown and black samples of the different fabrics were not affected. No odour of DDT was detected in treated clothing either in the laboratory or when it was being worn, and the texture of the fabrics was unaltered. DDT is not adsorbed from solution by textiles, but the DDT remaining after drying was shown to be completely retained mechanically in the fibres. It was not resistant to dry cleaning, but could be wet cleaned or steam spotted several times without appreciable decrease in the moth-proofing power, though repeated wet cleaning made retreatment necessary [*cf. R.A.E.*, A **36** 324]. Continuous operation of the process for three years showed that there was no corrosion of equipment or other deleterious effect due to DDT.

MOLNAR (N. M.). **A new Mothproofing Larvacide.**—*Soap & sanit. Chem.* **23** no. 7 pp. 143, 145, 147, 149, 3 refs. New York, N.Y., 1947.

Hexachlorethane has been shown to be toxic to larvae of *Tineola biselliella*, Humm., but slower in action than paradichlorbenzene or naphthalene [*R.A.E.*, A **27** 635], and the toxicity of volatile organic compounds has been stated to vary inversely with their volatility [**6** 253]. In studies of evaporation rates at 25–30°C. [77–86°F.], pure hexachlorethane, paradichlorbenzene and naphthalene lost 35·6, 98·8 and 14·6 per cent. of their weight in a week, intimate mixtures of paradichlorbenzene and hexachlorethane (1 : 1) lost 97·6 per cent., and the evaporation rates of mixtures of naphthalene and

hexachlorethane were greater than those of either material alone ; a product prepared by melting a mixture of hexachlorethane and naphthalene (4 : 1) at temperatures of 60–78°C. [140–172·4°F.] lost approximately 5 per cent. of its weight per day at 70–80°F. and evaporated completely in three weeks.

To test the larvicidal properties of the materials, open petri dishes containing samples of woollen cloth and ten active *Anthrenus* larvae were put in individual cardboard cartons containing pure paradichlorbenzene crystals or the mixture of hexachlorethane and naphthalene (4 : 1) at the rate of 1 lb. per 50 cu. ft., so placed that the larvae were subjected to the action of the fumes only. The containers were then made as airtight as possible, to simulate conditions in a storage chest, and kept at 28–30°C. [82·4–86°F.] for 15 days. After that time, 90 per cent. of the larvae exposed to the mixture were dead, whereas all those exposed to paradichlorbenzene were alive. The living larvae were removed from the containers and kept at the same temperatures for seven days, after which the remainder of the larvae exposed to the mixture were dead and all those exposed to paradichlorbenzene were still alive. In a comparison by the same method of paradichlorbenzene alone and with hexachlorethane (1 : 1), the mixture killed 30 per cent. of the larvae, whereas pure paradichlorbenzene killed none, and no larvae died during the seven-day period after treatment. The paradichlorbenzene had a definite protective action in that it prevented the larvae from feeding, but it was obviously less effective than either of the mixtures as a larvicide.

The median lethal doses of naphthalene, paradichlorbenzene and hexachlorethane to *Anthrenus* larvae were found to be 1, 3 and more than 6 mg. per litre. The insects exposed to hexachlorethane exhibited symptoms resembling those of DDT poisoning. When different stages of *Attagenus* [*piceus*, Ol.], *Anthrenus* and *Tineola biselliella* were exposed for three weeks at temperatures averaging about 65–70°F. to paradichlorbenzene, hexachlorethane or a mixture of the two (1 : 9), applied at the rate of 1 lb. per 100 cu. ft. in containers that were not quite airtight, paradichlorbenzene was less effective than hexachlorethane or the mixture, which both gave complete mortality against eggs, pupae and adults of *Attagenus*, and the mixture was apparently more effective than the pure compounds against larvae of *Attagenus*, *Anthrenus* and *Tineola*, as shown by the amount of feeding or the quantity of frass produced, though there was no mortality of *Attagenus* larvae and practically none of *Anthrenus*. It was found that for commercial use a mixture of hexachlorethane and paradichlorbenzene (1 : 1) was desirable, because its evaporation rate was the same as that of pure paradichlorbenzene and its toxicity to insects considerably greater in many instances and equal in others. The addition of naphthalene to paradichlorbenzene is also expected to produce a synergistic effect, but if more than 5 per cent. naphthalene is incorporated in paradichlorbenzene, a cryogenic mixture is formed. This does not occur when naphthalene or paradichlorbenzene is mixed with hexachlorethane. The mixture of hexachlorethane and naphthalene (4 : 1) is considered a valuable new larvicide as it combines the desirable features of naphthalene and hexachlorethane, having a lower melting point, much greater volatility and a greater fumigating effect than either of the components.

Swezey (O. H.). **Insect Invaders in Hawaii during and since World War II.**— *J. econ. Ent.* **41** no. 5 pp. 669–672. Menasha, Wis., 1948.

A list is given of 31 species of insects that have become established in Hawaii and were first observed there during 1943–48. Some of them have already been recorded [*R.A.E.*, A **36** 249 ; **37** 122, etc.] ; others of potential economic importance, of which all but the last are stated to have been found on Oahu, include *Lygus elisus*, Van D., found breeding on *Chenopodium album* in 1947,

the Noctuids, *Polydesma umbricola*, Boisd., which defoliated the monkey pod tree [*Pithecolobium saman*] in 1945 but was controlled by natural enemies in later years, and *Stictoptera subobliqua*, Wlk., attacking *Calophyllum inophyllum*, *Garcinia xanthochymus*, *Mammea americana* and *Clusia rosea* in 1948, *Phytomyza spicata*, Mall., which was first observed in 1946 and has been found mining the leaves of young maize, sugar-cane and grasses but is apparently well controlled by Eulophid parasites, of which the most important is *Hemiptarsenus semialbiclavus*, Gir., the Sphegids, *Polemistus luzonensis*, Rohw., which probably stores its nests with Aphids, and *Liris aurata*, F., which preys on *Gryllus* and *Gryllodes*, the Eumenids, *Eumenes latreillei petiolaris*, Schulz, *E. campaniformis*, F., and *E. pyriformis philippinensis*, Beq., which prey on caterpillars, and the Encyrtid, *Chrysoplatycerus splendens*, How., reared from *Pseudococcus citri*, Risso, and *P. maritimus*, Ehrh.

ESSIG (E. O.). **Insect Surveys in Relation to Quarantine and Control of Insect Pests.**—*J. econ. Ent.* **41** no. 5 pp. 673–677. Menasha, Wis., 1948.

The following is substantially the author's summary of this paper, which is written with special reference to California. Insect surveys are important to entomologists making collections, writing technical papers, enforcing quarantine regulations and conducting programmes for the control or extermination of insects, and should include thorough examination of cultivated and wild areas, public and private collections and all published reports and records. Such surveys form a basis for legislative action and the prevention of outbreaks of native and introduced insect pests.

WEBSTER (R. L.). **Mites of economic Importance in the Pacific Northwest.**—*J. econ. Ent.* **41** no. 5 pp. 677–683. Menasha, Wis., 1948.

In view of the increases of mites that have followed the use of DDT against insect pests on various plants in the north-western United States, the author gives notes on the seasonal history, food-plants and control of the more important species found there. These are *Tetranychus pacificus*, McG., on apple, *Eriophyes pyri*, Pgst., on apple and pear, *Bryobia praetiosa*, Koch, on apple (early in the season) and stone fruits, *Paratetranychus pilosus*, C. & F., on fruit trees, *Tetranychus willamettei*, McG., on fruit trees and raspberry, *Phyllocoptes gracilis*, Nal., on raspberry and loganberry, *Aceria* (*E.*) *essigi*, Hassan, on blackberry, raspberry and loganberry, *Tetranychus bimaculatus*, Harvey, on hops and potato, and *Vasates schlechtendali*, Nal., and other rust mites on apple, pear and cherry ; according to Keifer [*R.A.E.*, A **36** 82–83], those on pear are *Epitrimerus pyri*, Nal., and those on prune and cherry *V. fockeui*, Nal. & Trt.

MCGREGOR (E. A.). **Classification, Food Plants, and Distribution of the Spider Mites.**—*J. econ. Ent.* **41** no. 5 pp. 684–687, 1 ref. Menasha, Wis., 1948.

The author's previous revision of the Tetranychids [*R.A.E.*, A **8** 145] included seven genera ; he is now engaged on one in which he recognises 16, four of which are new. In this paper he describes characters by which the genera, including those not yet named, can be distinguished and discusses the distribution and economic importance of the Tetranychids of the western coast of North America, with special reference to the United States.

Wingo (C. W.) & Thomas (G. W.). **Development of the Two-spotted Spider Mite in the Presence of DDT and other Insecticides.**—*J. econ. Ent.* **41** no. 5 pp. 688–691, 4 refs. Menasha, Wis., 1948.

Tetranychid mites, particularly *Tetranychus bimaculatus*, Harvey, and *Paratetranychus pilosus*, C. & F., have become important pests in orchards sprayed with DDT, and experiments were carried out in Missouri to determine the influence of various concentrations of DDT and other insecticides and acaricides on *T. bimaculatus* on soy bean in the absence of predators. The plants were sprayed before and again a few days after being artificially infested, and mites and eggs were counted after a further fortnight. In preliminary tests, 0·25 or 0·5 per cent. DDT significantly reduced the reproduction of *T. bimaculatus*, and in later ones, 1 or 0·75 per cent. DDT or 0·009 per cent. parathion practically eliminated mites and eggs, whereas 0·125 per cent. DDT permitted about 25–30 per cent. as many mites to develop as in the control and 0·125 per cent. chlordan was even less effective. The higher concentrations of DDT resulted in stunting and severe scorching of the young soy-bean plants and the lower ones in slight stunting and chlorosis.

In the last test, the percentage reductions in final populations as compared with no treatment were about 45 for 0·125 per cent. DDT as an emulsified solution or a wettable powder and 0·125 per cent. chlordan as a wettable powder, 75 for 0·125 per cent. methoxy-DDT (methoxychlor) or chlorinated camphene [toxaphene] as wettable powders, and over 95 for 0·009 per cent. parathion and 0·125 per cent. bis(parachlorphenoxy)methane as wettable powders and an experimental insecticide-fungicide of the dinitro type, which was used as a wettable powder and in an emulsion and injured the plants in both forms ; 0·125 per cent. benzene hexachloride (12 per cent. γ isomer) was relatively ineffective, and plants sprayed with 0·111 per cent. xanthone had much higher mite populations than untreated ones.

Newcomer (E. J.) & Dean (F. P.). **Studies of Orchard Acaricides.**—*J. econ. Ent.* **41** no. 5 pp. 691–694, 3 figs., 1 ref. Menasha, Wis., 1948.

In the tests described on the control of *Paratetranychus pilosus*, C. & F., and *Tetranychus pacificus*, McG., in apple orchards in the Pacific Northwest of the United States in 1947, acaricides were either added to the DDT or other sprays applied against *Cydia* (*Carpocapsa*) *pomonella*, L., or used alone. All spray quantities given below are per 100 U.S. gals., and the following abbreviations are used : BHC powder for a wettable powder containing enough benzene hexachloride to give 6 per cent. γ isomer, which was applied in some sprays for the control of *Eriosoma lanigerum*, Hsm. ; DN salt for the dicyclohexylamine salt of dinitro-o-cyclohexylphenol ; and TEPP for technical tetraethyl pyrophosphate (9 per cent. tetraethyl phosphate with 16 per cent. other organic phosphates).

In tests against *P. pilosus*, three applications of 2 lb. technical xanthone with DDT kept the mite at a low level throughout the season, and five of 1 lb. were almost as good. The DN salt controlled the mites well during the early part of the season when used at 1 lb. with 1 lb. DDT, but gave poor results later when reduced to 0·5 lb. which is the maximum concentration considered safe during hot weather. One plot on which a standard treatment of 3 lb. cryolite and 1 U.S. quart oil was used against *C. pomonella* became heavily infested with *P. pilosus* owing to the use of DDT on the rest of the orchard, but complete control was obtained with one application of 0·5 lb. wettable powder containing 15 per cent. parathion on 17th July. One application of 3 lb. BHC powder followed by two of 0·5 U.S. pint TEPP and one of 0·25 lb. 15 per cent. parathion resulted in low mite populations, as did five applications of 0·5 U.S. pint TEPP and

several of 1 U.S. pint 1 per cent. rotenone or 2 U.S. quarts mineral oil. Neither of the last two materials was as effective as xanthone.

On trees infested by *T. pacificus*, the cryolite spray, with 2 lb. BHC powder added to three of the applications, permitted a fairly large mite population to persist throughout the season. Xanthone was less effective against *T. pacificus* than against *P. pilosus*, and seven applications at 1 lb. gave much the same control as five at 2 lb., both used with DDT. Methoxy-DDT used instead of DDT permitted a fairly heavy mite infestation to develop by the end of June, but one application of 0·5 U.S. pint TEPP followed by one of 2 lb. xanthone on 14th July gave fairly good control for the rest of the season. In plots in which 3–4 applications of DDT were made against *C. pomonella*, the addition of the DN salt resulted in better control of *T. pacificus* than it had of *P. pilosus*. An application of 0·5 U.S. pint TEPP on 30th June gave temporary control of mites on a plot receiving three applications of DDT with BHC powder, and one of 0·5 lb. 15 per cent. parathion powder on 14th July reduced the population to zero. A month later there was a population of about 40 mites and 40 eggs per leaf, but a second application of 0·25 lb. parathion powder again reduced it to a very low level. Five applications of TEPP at 0·5 U.S. pint controlled the mites well, but seven of rotenone were needed for similar control.

On other trees sprayed with DDT, 0·5 lb. 50 per cent. chlordan emulsion concentrate gave good control of *T. pacificus* until the end of June, but not later, although applied seven times, three applications of 1·5 U.S. pints 25 per cent. emulsifiable 1,1-bis(parachlorphenyl)ethanol in May and June gave such complete control that no further spraying was necessary, and five of 2 lb. 40 per cent. 1,1-bis(parachlorphenoxy)methane or 1 U.S. pint 50 per cent. water-miscible chlorinated camphene [toxaphene] gave very good control, but seven of fused bentonite-sulphur were needed for fair control. The only material to cause plant injury was 1,1-bis(parachlorphenoxy)methane, which produced small russet spots on about half the apples.

It is concluded that of the acaricides tested, 1,1-bis(parachlorphenyl)ethanol and parathion are the only ones that show promise of being effective when used with DDT in a practicable number of sprays. In view of their persistent effect, as few as three applications of either per season might be sufficient.

Wilcox (J.) & Howland (A. F.). **DDT Dust for Control of Onion Thrips.**— *J. econ. Ent.* **41** no. 5 pp. 694–700, 1 fig., 4 refs. Menasha, Wis., 1948.

In 1944, the authors obtained better control of *Thrips tabaci*, Lind., on bulb onions with DDT than with other insecticides. Since a 10 per cent. dust was the most promising of the DDT preparations used, experiments on the timing and number of applications of this dust for the control of thrips on table onions were carried out in nine fields in southern California in 1945, 1946 and 1947. Each year the dust was applied at 30 lb. per acre to eight plots in each of three fields during a nine-week period from the time the plants were 10 ins. high, either once a week for the first, middle or last three weeks or for the first or last six weeks of the period, or three or five times in alternate weeks. Most of the treatments reduced the numbers of larvae by at least 90 per cent., though when applications ceased at the end of three or six weeks the larval populations reached their original size after another three weeks. This lack of persistent action was thought to be due to rapid plant growth. The control of adults, as shown by counts made a week after the end of each series of applications, averaged about 64 per cent., but would probably have been higher if counts had been made sooner, since the adults are sufficiently active to redistribute themselves from untreated areas in a week. Increased yields were obtained from the treatments in six of the nine fields.

The main difference between the damaged and undamaged fields was due to increases in population during the first six weeks, which were associated with

higher temperature. Frost also appeared to influence the population levels, especially at the beginning of the season. Averages of 8·3, 20·7 and 77·8 larvae per undusted plant during the first, second and third three-week periods, respectively, caused no measurable damage, whereas populations of 20·5, 60·5 and 141·8 per plant during the same periods were injurious. Most damage occurred during the first six weeks, when the onions were smaller and the populations lower than in the last three. With onions 10 ins. high and populations of between 8·5 and 35 larvae per plant, more benefit was obtained from treatments begun when populations were smaller. Treatments begun when the onions were 10 ins. high appeared to be more effective than treatments begun when they were 16 ins. high, and either were significantly more effective than treatments begun when the onions were 22 ins. high. When the cost of treatment and the error were considered, it was found that three applications at intervals of two weeks or six at intervals of one week, beginning when the onions were 10 ins. high, were the most profitable.

Bailey (S. F.). **Grain and Grass-infesting Thrips.**—*J. econ. Ent.* **41** no. 5 pp. 701–706, 1 fig., 49 refs. Menasha, Wis., 1948.

The author summarises the life-histories and distribution of the thrips known to be injurious to cereals and grasses in various parts of the world. *Stenothrips graminum*, Uzel, and *Chirothrips hamatus*, Tryb., on grasses, and *Haplothrips aculeatus*, F., and *H. tritici*, Kurdj., on cereal crops, are known only from the Old World, as are the rice thrips, *Thrips oryzae*, Williams, which occurs in India and *H. oryzae*, Mats., and *H. japonica*, Mats., which occur in Japan. *Anaphothrips obscurus*, Müller, *A. secticornis*, Tryb., *Limothrips cerealium*, Hal., *L. angulicornis*, Jabl., *Chirothrips aculeatus*, Bagn., and *Aptinothrips rufus*, Gmel., all found mainly on grasses, *L. cerealium*, Hal., on grasses and cereals and *L. denticornis*, Hal., on cereals, are known in both Europe and North America, and certain species have been found in North America only. These include *Anaphothrips reticulatus*, Moulton, which breeds entirely on grasses, *Prosopothrips cognatus*, Hood (Kansas wheat thrips), attacking wheat or grasses, and *Frankliniella tritici*, Fitch, *F. occidentalis*, Perg., *F. moultoni*, Hood, *F. fusca*, Hinds, and *F. cephalica bispinosa*, Morg., which are well-known crop pests, but are relatively unimportant as grain and grass pests. A list is given of other species that are found on grains and grasses in the western United States, but not in sufficient numbers to be of any concern. Certain predacious thrips, chiefly *Aeolothrips fasciatus*, L., *A. bicolor*, Hinds, *Leptothrips mali*, Fitch, and *Scolothrips sexmaculatus*, Perg., are found on grasses and cereal crops.

Although several of the species that are injurious to cereals in Europe are also found in the United States, little specific information is available on the losses of grain caused by thrips in North America. The cultural practices, particularly common in the far western States, of burning and ploughing grain fields after harvest discourage the establishment of thrips over large areas, and the hot dry weather normal after harvest in the far west forces thrips to disperse to other food-plants, so that each winter and spring they gradually migrate into the fields again and do not reach a maximum population until May and June. However, with the trend towards permanent pastures and the development and planting of new range grasses, thrips appear likely to assume greater importance in years of favourable weather.

Martin (C. H.). **Movement and seasonal Populations of the Garden Centipede in Greenhouse Soil.**—*J. econ. Ent.* **41** no. 5 pp. 707–715, 5 refs. Menasha, Wis., 1948.

Scutigerella immaculata, Newp., is known to injure the underground parts of crops in the field and in the greenhouse but the way in which it moves through

the soil is not well understood. The author has found that under certain conditions there is no regular seasonal migration to and from the surface of greenhouse soil and that the symphylids do a considerable amount of travelling over the surface of the soil ; probably it is this surface-travelling population that reinfests depopulated areas and attacks the roots of crops. Experiments in Ohio with depopulated areas, systematic population counts throughout the year within the same areas, and observations of symphylid movement in cages, correlated with observations on soil and structure and the biology of the symphylids, have led to some hypotheses on their movement in the soil, and in this paper the author discusses their movements through greenhouse soil and some of the possible factors that may be correlated with movement. The following is based on his summary.

Two types of openings offer symphylids pathways through the soil. These are the gross openings, which may be in vertical or horizontal planes, and the network of interspaces between soil particles. The gross openings include cracks in the soil and fissures formed by the irregular contact of the soil particles with the surfaces of retaining boards, posts in the soil and foundations. Horizontal cleavage planes exist between the top soil and clay subsoil, and artificial horizontal planes are formed by the burying of organic material in the soil. The symphilids could pass through soil where interspaces between soil particles were sufficiently large, but they could not enter sand or soil of flour-like consistency, or heavy soil unless fissures were present.

The symphilid population was generally smaller in the top six inches of soil than below this level. The habit of depositing eggs more than six inches below the surface, differences in the rate of movement in the top and subsoil, the random movements of the symphilids in the soil and the movements of the immature population contributed to the difference between the top-soil and subsoil populations. Factors contributing to the appearance of large top-soil populations are sheer numbers in soil not treated for several years and very wet soil. Drying of the top soil caused the population in this stratum to disappear. The immature symphilids were most numerous from April to July. Because the distribution of the immature population is similar to that of the adults, and because the young can crawl through smaller spaces than the adults, it is suggested that the movements of the immature symphilids may determine the distribution of the adult population to a considerable degree.

Kulash (W. M.). **The Control of the Rice Weevil and the Angoumois Grain Moth.**—*J. econ. Ent.* **41** no. 5 pp. 715–718. Menasha, Wis., 1948.

Calandra (*Sitophilus*) *oryzae*, L., and *Sitotroga cerealella*, Ol., are two of the most destructive pests of stored maize in North Carolina. Both are abundant in the coastal-plain sections of the State, but *S. cerealella* is the more injurious in the western sections. Infestation generally begins in the field, and the warm, humid conditions prevailing in most of the State favour the development of these insects in storage bins. Their presence in maize reduces its value for milling, and the growing importance of the production of hybrid seed in North Carolina increases the need for control. Since the lack of proper facilities on many farms precludes fumigation, tests were begun in the autumn of 1946 to determine the effectiveness of treatment with DDT.

In the laboratory tests, shelled maize was immersed in a modified slurry for one minute or treated with dusts at the rate of one part dust to 1,000 parts maize by weight. A slurry prepared from a 25 per cent. water-miscible concentrate and containing as little as 0·125 per cent. DDT checked the development of both species for three months, and concentrations of 0·25, 0·5 and 1 per cent. DDT were not markedly more effective. All these treatments were slightly more effective than a 5 per cent. DDT slurry prepared from a concentrated wettable powder and than a 5 per cent. DDT dust. A fungicide used

as a dust or as a modified slurry did not protect seed maize from *S. cerealella*, but a mixture of 5 per cent. DDT and fungicide (1 : 1), applied as a dust or modified slurry, was effective against both species. Neither DDT nor the fungicide reduced germination.

In the practical tests, samples of husked and unhusked maize were treated with 5 per cent. DDT as a water-miscible spray or a dust and shelled maize with 5 per cent. DDT dust or slurry and exposed to infestation under normal storage conditions. After a year, the percentages of total infestation by the moth and weevil were 6·4 and 7·5 for the two treatments on maize with the husks on, as compared with 19·3 for no treatment and 6·6 and 17·1, as compared with 84·5, for maize with the husks off ; for the two treatments on shelled maize, they were 19·5 and 13·5, as compared with 31·5.

FINNEY (G. L.). **Culturing *Chrysopa californica* and obtaining Eggs for Field Distribution.**—*J. econ. Ent.* **41** no. 5 pp. 719–721, 1 ref. Menasha, Wis., 1948.

An account is given of the methods used to produce large numbers of eggs of *Chrysopa californica*, Coq., in the laboratory in California for distribution in the field. The adults are kept in batches of 100 in cartons of 1 U.S. gal. capacity, lined with paper and having a cover of black gauze on the top. For the first two weeks after emergence they are fed on honey presented to them in small droplets on waxed paper. During this time there may be light oviposition, but this soon decreases to only a trace. At the end of two weeks, the diet is supplemented with honey-dew from *Pseudococcus citri*, Risso, obtained by leaving a sheet of waxed paper for 3–4 days about two inches below sprouting potatoes infested with the mealybug ; this induces oviposition within five days, and egg-production soon reaches about 150 per carton per day, but if the honey-dew is withheld, it decreases to a mere trace. A ball of wet cotton in each carton keeps the honey and honey-dew moist. The adults are inactive during the day, and oviposition occurs chiefly at night. The eggs are distributed singly and evenly over the gauze top and paper lining and hatch in about 108 hours at 75°F. The adults are anaesthetised with carbon dioxide and moved to fresh cartons three times a week, and egg-bearing papers and gauzes are stored in a cool place for field distribution.

To obtain further breeding material, about 850–900 Chrysopid eggs are scattered evenly over a sheet of paper (40 × 16 ins.) bearing eggs of *Gnorimoschema operculella*, Zell., which is obtained by exposing the sheet for 24 hours in an oviposition cage containing 2,000 moths. The moth eggs should be as fresh as possible and the *Chrysopa* eggs ready for immediate hatching. The egg sheet is fixed in a tray and is covered with a plain sheet for 3½ days, after which this is replaced by a second egg sheet, egg-side down. The relative humidity should be about 80 per cent. After three days, the second egg sheet is rolled back, 2,500–3,500 fully-fed processed *Gnorimoschema* larvae [*cf. R.A.E.*, A **37** 207] are distributed over the first egg sheet and this is covered with the second egg sheet again. A few of the caterpillars are scattered over this to feed any Chrysopid larvae that wander to the top. The *Chrysopa* larvae are given two additional meals of processed caterpillars at intervals of two days. The relative humidity should be reduced to 50 per cent. as soon as processed larvae are used. The entire culture period should be about 15 days at 74–76°F. The cocoons are removed from the trays and kept in containers similar to those used for oviposition. Emergence begins in about 8–9 days, and adults are anaesthetised with carbon dioxide and removed each day. Mating is readily accomplished in the pre-oviposition units, and the sex ratio seems to be quite favourable and has presented no serious problem.

Woodside (A. M.). **Tetraethyl Pyrophosphate for Control of the Periodical Cicada.**—*J. econ. Ent.* **41** no. 5 pp. 722–724. Menasha, Wis., 1948.

In tests of some of the newer insecticides against *Magicicada septendecim*, L., in Virginia in 1948, sprays of 4 lb. 50 per cent. DDT, 4·5 lb. 50 per cent. BHC (benzene hexachloride containing 12 per cent. γ isomer), 6 lb. 25 per cent. ditolyl trichlorethane [methyl-DDT] or chlorinated camphene [toxaphene], 3·75 lb. 40 per cent. chlordan or 3 lb. 25 per cent. parathion per 100 U.S. gals., applied to the trunks and large branches of mature apple trees and the undergrowth and soil under them 2–4 days after the beginning of emergence from the soil in May did not reduce emergence. In laboratory tests in which caged adults were sprayed with these materials and with hexaethyl tetraphosphate and TEPP (35 per cent. tetraethyl pyrophosphate and 65 per cent. related phosphates), TEPP was the only insecticide that showed much promise, and it was as effective at 0·25 as at 1 pint per 100 gals. On 21st May, small plots of apple trees were sprayed with TEPP at 4 or 8 oz. per 100 U.S. gals. and with BHC, parathion and chlordan at the same rates as before. It was impossible to detect any effect of the last three on the cicadas, which flew rapidly from tree to tree at temperatures above 70°F., but TEPP gave a satisfactory kill at the higher concentration, though it was slower in action and possibly less completely effective at the lower one. Applied at 6 oz. per 100 U.S. gals. over a larger area on 22nd May, it gave practically complete kill. As a result of these tests, TEPP (35 or 40 per cent. tetraethyl pyrophosphate) was applied to the entire orchard at 6 oz. per 100 U.S. gals. between 25th and 28th May and again between 1st and 5th June, when adults were still emerging and migrating from neighbouring woods. After this, the main part of the orchard remained almost completely free of living cicadas, but they continued to migrate into the parts near woods, and additional applications were made to these areas until some had received five. Comparison of this orchard and an unsprayed one showed that the injury to the branches caused by oviposition punctures was 83 per cent. lower in the sprayed orchard, in spite of heavier emergence there, though it was nearly three times as heavy in trees near woods as in the middle of the orchard. Other treated orchards showed similar results. Observations at the time of spraying showed that high-powered machines that delivered a large volume of spray and covered the trees quickly were much more effective than those that required more time to cover a tree, since slow coverage permitted the escape of some of the insects. Sprays applied from the top of the sprayer or from a tower were more effective than those applied from the ground, as spray entering the tree from below shook the branches and caused some of the cicadas to fly from the top of the tree before they were touched by the spray. TEPP affected the cicadas very quickly, but was not observed to injure those that flew into the trees after treatment. Flying cicadas showed a tendency to avoid sprayed trees until the spray had dried. The value of the spray depended to a considerable extent on the rapidity with which the orchard could be covered. The addition of flotation sulphur and DDT decreased its effectiveness.

Satterthwait (A. F.). **Important Sunflower Insects and their Insect Enemies.**—*J. econ. Ent.* **41** no. 5 pp. 725–731, 3 refs. Menasha, Wis., 1948.

Several insects attack sunflower (*Helianthus annuus* and *H. mollis*) in the United States and hinder the production of seeds and oil. Some of them have already been recorded [*cf. R.A.E.*, A **36** 83, 150], and in this paper the author discusses four others that have been found to be of some importance and their natural enemies. The following is based on his summary. *Rhodobaenus tredecimpunctatus*, Ill., has one generation in the year, and the adult weevils leave the food-plant to overwinter in other shelter. Eggs are laid in feeding excavations in the stalk or leaves, beginning late in May at St. Louis, Missouri.

The larval and pupal stages last about ten weeks and five days, respectively. *Muscina stabulans*, Fall., was the only natural enemy reared [*cf.* **32** 135], and the elimination of wild food-plants and trash are recommended for control.

Suleima helianthana, Ril., has two or more generations in the year and apparently overwinters as a mature larva. Eggs are laid near the terminal or more tender axillary buds, which the larvae enter. The larval and pupal stages last about 40 and 6 days, respectively. One predator, *Hydnocera pubescens*, Lec., and eight parasites, *Lixophaga variabilis*, Coq., *Epigrimyia* (*Siphophyto*) *floridensis*, Tns., *Sarcophaga rapax*, Wlk. (*Helicobia helicis*, Tns.), *Muscina stabulans*, *Bracon* (*Microbracon*) sp., *B.* (*M.*) *caulicola*, Gah., *Apanteles epinotiae*, Vier., and *Pristomerus euryptychiae*, Ashm., were found. The destruction of trash should help to control this Tortricid.

Stibadium spumosum, Grote, has only one generation a year. The eggs are laid in the sunflower head, and the larvae mature in about 30 days and pupate in the soil. The pupal stage lasts about ten months. One predator, *Hydnocera pubescens*, and four parasites, *L. variabilis*, *Sarcophaga rapax*, *B.* (*M.*) *mellitor*, Say, and *Chelonus altitudinus*, Vier., contributed to its control. Ploughing after harvest and before winter should help to control this Noctuid.

Lasioptera murtfeldtiana, Felt, has probably two or more generations in the year. It overwinters as a mature larva. Eggs are laid in the head, especially in open florets, sometimes many to a floret. The larva enters the embryonic achene and feeds on the germ. When ready to issue, the pupa forces itself through a crack. Infestation is difficult to detect, because no hole is cut and the devitalised achenes are blown away with the chaff at harvest. This Cecidomyiid was attacked by one predator, *Orius insidiosus*, Say, and three parasites, *Torymus obscurus*, Breland, *Platygaster* sp. and an undescribed species of *Rileya*.

PARENCIA jr. (C. R.) & EWING (K. P.). **Control of the Cotton Fleahopper by Chlorinated Camphene, DDT and Sulphur.**—*J. econ. Ent.* **41** no. 5 pp. 735–738, 4 refs. Menasha, Wis., 1948.

Psallus seriatus, Reut., has been successfully controlled on cotton in Texas since 1946 with a dust containing 5 per cent. DDT and 75 per cent. sulphur applied early in the season [*cf. R.A.E.*, A **35** 398], but this does not control *Anthonomus grandis*, Boh., which is often present in potentially injurious numbers, and frequently results in increased infestation by *Aphis gossypii*, Glov. Since preliminary experiments indicated that chlorinated camphene [toxaphene] was promising against all these insects [*cf.* **37** 196], it was compared with the dust of DDT and sulphur against *P. seriatus* in 1947. On small plots treated four times in June, the DDT dust and dusts containing 1·25–10 per cent. toxaphene all gave significant control, though 1·25 and 2·5 per cent. toxaphene were significantly less effective than 10 per cent., and all but 1·25 and 10 per cent. toxaphene gave significant increases in yield ; 5 per cent. toxaphene was as effective as the DDT 24 hours after treatment, but had a much less persistent effect, and 10 per cent. toxaphene was required to equal the DDT in persistence.

In large-scale tests at Port Lavaca, in which 1–3 applications were made in June or late May and June and all materials gave good control and increases in yield except when root rot intervened, 10 per cent. toxaphene, alone in clay and pyrophyllite or with 50 per cent. sulphur, was as effective and persistent as the DDT dust, and resulted in larger yields, possibly owing to the control of small infestations of other insects ; 5 per cent. toxaphene was as good as DDT in immediate kill, but had less persistent effect. On some plots toxaphene without sulphur resulted in increases in red spiders [*Tetranychus*]. In a large-scale test at Waco, where three applications were made in

June and July, 10 or 20 per cent. toxaphene gave good control and sulphur alone very little. Cotton dusted with toxaphene began to fruit much more quickly and was ready for harvesting several weeks earlier than cotton dusted with sulphur and yielded 67 per cent. more than untreated cotton, as compared with 30 per cent. increase from sulphur. Toxaphene was found to act so quickly on the fleahoppers that rain soon after dusting made little difference to the results.

STITT (L. L.). **Reduction of the vegetative Growth of Alfalfa by Insects.**— *J. econ. Ent.* **41** no. 5 pp. 739–741, 1 fig., 2 refs. Menasha, Wis., 1948.

The following is substantially the author's summary. Field-cage experiments were carried out at Bard, California, in 1941 and 1942 to determine how much, if any, reduction in the growth of lucerne was caused by insects. Experiments were made on the July, August and September crops in 1941 and on the May and June crops in 1942. For each crop, screen-wire cages were kept stocked with one or more species of the insects swept from the plot on which the cages were situated, and observations were made on plant heights and the appearance of the different hay crops in these cages, in insect-free cages and in the area outside the cages. The results indicated that insects materially reduced the vegetative growth during the period from June to September. The most abundant insects in fields of reduced growth were *Empoasca fabae*, Harr., *Lygus* spp. (*L. hesperus*, Knight, *L. oblineatus*, Say, and small numbers of *L. elisus*, Van D.) and *Stictocephala festina*, Say. When samples of ten and 25 of each of these and of *Creontiades femoralis*, Van D., were caged separately on individual plants, all except *S. festina* caused highly significant reductions in growth, as compared with insect-free cages.

DRAKE (C. J.). **Influence of Insects on Alfalfa Seed Production in Iowa.**— *J. econ. Ent.* **41** no. 5 pp. 742–750, 8 refs. Menasha, Wis., 1948.

Insects affect lucerne seed production by feeding on the young and fruiting plants and by acting as pollinating agents. In Iowa, the first lucerne crop is cut for hay and the second sometimes allowed to stand for seed. Several harmful insects are just attaining destructive proportions about the time that the first crop is cut, and many species of pollinating insects are most abundant during late July and August when the seed fields are in full bloom. *Empoasca fabae*, Harr., *Lygus* spp., largely *L. oblineatus*, Say, *Adelphocoris lineolatus*, Goeze, *A. rapidus*, Say, and *Bruchophagus gibbus*, Boh., occur in destructive numbers in lucerne fields every year. In most parts of Iowa, *E. fabae* almost invariably causes heavy reductions in the yield of the second and third hay crops, but the first hay crop is cut before the leafhopper becomes numerous after its migration into the State from the south. Two applications of about 1·5 and 2 lb. DDT per acre, respectively, made in sprays or dusts about 12–15 days apart, with the second treatment just as the first buds begin to open, so that the toxic materials are on the outer surface of the unfolding flowers and do not interfere with the activities of the pollinating insects, protect the young seed crop during the growing period and maturing plants during the period of fruiting and seed formation. As a result of such treatment, the vegetative growth of the seed crop is generally about as heavy as that of the first crop harvested for hay. When grasshoppers are present in harmful numbers, γ benzene hexachloride, chlorinated camphene [toxaphene] or chlordan added to the DDT in the spray or dust gives good control.

Lucerne is largely dependent on insects for pollination, and as bees are the primary agents [*cf. R.A.E.*, A **36** 10; **37** 147, etc.], they must be present in numbers large enough to trip and cross-pollinate the flowers if seed production

is to be heavy. Megachilids, *Bombus* spp. and certain other wild bees are fast, active and very effective, but the primary species concerned often vary considerably from one area to another in both numbers and composition. The author gives a list of insects found tripping lucerne flowers in the vicinity of Ames, with notes on their tripping abilities and rates per minute. Honey bees were predominant in every lucerne seed field and made up for their poor tripping ability by their numbers. Megachilids and *Bombus* were effective trippers and the most important pollinators, and several other species of wild bees tripped flowers, but they were not very common in lucerne fields. *Chauliognathus pennsylvanicus*, Deg., was of minor importance and was the only beetle observed actually tripping flowers for pollen. Moderate numbers of honey bees seemed very helpful in seed production, but high yields depended on the presence of such good trippers as *Bombus* and Megachilids. The efficiency of the pollinating insects was doubled and even trebled by staggering the cutting of the first hay crop at 8–10-day intervals so that the flowering period of a field was prolonged from ten to 20 or even 40 days. This also favoured honey bees as demonstrated by honey yields. Situating seed fields along rough land, streams and open timber was also helpful, because of the more favourable nesting and breeding sites for wild bees, which depend on wild flowers for food and provision for their nests.

Sun (Yun-Pei), Norton (L. B.) & Rawlins (W. A.). **Factors affecting Toxicity in formulating Chlordan Emulsions.**—*J. econ. Ent.* **41** no. 5 pp. 751–755, 3 refs. Menasha, Wis., 1948.

Various factors affecting the toxicity of chlordan in liquid formulations were tested, by diluting emulsion concentrates with water and spraying them at the rate of about 4·5 mg. dilute emulsion per sq. cm. on pieces of squash leaf infested by *Aphis gossypii*, Glov. The living Aphids were counted just before and 24 hours after spraying, and the percentages by which their numbers were reduced by the sprays were calculated by the formula of Sun & Shepard [*R.A.E.*, A **37** 250] ; the efficiency figures given below are these percentages. The standard emulsion concentrates used contained 20 gm. chlordan, 77 ml. kerosene as solvent and 10 ml. Atlox 1045A (a polyoxyethylene sorbitol mixed fatty acid ester) as emulsifier.

In the first test, in which the concentrate was diluted to 1 : 1,000, increasing the content of emulsifier from 0·01 to 0·05, 0·1, 0·5 and 1 per cent. by volume increased efficiency from 13·1 to 26, 80·3, 84·4 and 91·6. The wetting ability of the sprays was poor at emulsifier concentrations of 0·01 or 0·05 per cent., but coverage was uniform at 0·1 per cent., and it was concluded that increase in emulsifier concentration beyond that necessary for the formation of a satisfactory emulsion was needed for maximum effectiveness, the additional emulsifier appearing chiefly to promote wetting and spreading, since further additions of emulsifier after good wetting was achieved produced relatively small increases in effectiveness. The addition to the diluted emulsion (1 : 800) of 0·02 per cent. sodium lauryl sulphate, which is water-soluble but not oil-soluble, and would be expected to add wetting and spreading properties to the dilute emulsion without radically changing the nature of the emulsion itself, increased its efficiency from 54·5 to 75·9, but further additions of the spreader to give concentrations up to 0·1 per cent. did not appreciably increase its effectiveness, confirming that improved wetting and spreading action was chiefly responsible for the increased effectiveness of emulsions containing more emulsifier than necessary for good emulsification.

In addition to the standard emulsifier, Triton B1956 (a modified phthalic glycerol alkyd resin), Duponol OS (a long-chain alcohol sulphate), Span 85 (technical sorbitan trioleate) and Tween 81 (a polyoxyalkylene ether of sorbitan

mono-oleate) were also tested at the same concentration and the concentrates were diluted to 1 : 500. All the emulsifiers mixed well with chlordan and kerosene, but the diluted concentrates varied in effectiveness of emulsification, though this was greatly improved by stirring for about ten minutes. The degree of wetting was about the same for all the emulsions, and there were no great differences in their effectiveness.

When the concentrations of kerosene and emulsifier in the sprays were those given by the standard concentrate at 1 : 500, but the amount of chlordan was varied, the efficiencies of sprays containing 0, 0·04, 0·1, 0·2 and 0·3 per cent. chlordan were 45·1, 70·4, 64·3, 54·3 and 49·4, respectively. It was observed that as the percentage of chlordan in the diluted emulsion increased, more oily material settled to the bottom of the container, and increasing the volume of emulsifier from 0·02 to 0·04 and 1 per cent. in a dilute emulsion containing 1 per cent. chlordan increased its efficiency from 80·2 to 91·4 and 97·4, showing that the addition of more emulsifier made more toxicant available.

At a dilution of 1 : 500, concentrates in which the solvents were Velsicol AR-50 (mainly methylnaphthalenes with a distillation range from 440 to 525°F.), Velsicol AR-60 (mainly methylnaphthalenes with a distillation range from 460 to 565°F.), kerosene (standard), pine oil and raw linseed oil had efficiencies of 49·4, 55·9, 65·7, 61 and 79·9, respectively, indicating that solvents may differ significantly as diluents for chlordan. After storage for eight months in closed bottles, concentrates made with some of the emulsifiers and solvents had separated into layers that did not coalesce when shaken. The nature of this change is not known, but such deterioration did not seem to occur in concentrates made with Velsicol, pine oil or raw linseed oil.

Smith (R. F.), Fullmer (O. H.) & Messenger (P. S.). **DDT Residues on Alfalfa Hay and Seed Chaff.**—*J. econ. Ent.* **41** no. 5 pp. 755–758, 8 refs. Menasha, Wis., 1948.

The following is based on the authors' introduction and summary. Since DDT is secreted in milk [*cf.* next abstract] and DDT residues on lucerne and other forage crops are therefore of importance, lucerne hay and lucerne straw from sprayed or dusted fields in various localities in California were analysed for DDT [*cf.* also *R.A.E.*, A **37** 419]. Straw from seed fields that had been dusted against *Lygus* with 5 per cent. DDT showed from 0 to 20 parts per million even after long weathering periods. Hay from fields treated with DDT for the control of *Colias eurytheme*, Boisd., showed amounts of DDT that varied owing to differences in application, plant growth, weathering and the moisture content of the hay. They were 0–1·9 p.p.m. for a 0·5 per cent. DDT dust and 3·7–10·3 for a 5 per cent. dust, both at 30 lb. per acre, and 0–12·1 and 36·4–47·2 p.p.m., respectively, for sprays of 0·25 and 1 lb. actual DDT per acre.

Smith (R. F.), Hoskins (W. M.) & Fullmer (O. H.). **Secretion of DDT in Milk of Dairy Cows fed low-residue Alfalfa Hay.**—*J. econ. Ent.* **41** no. 5 pp. 759–763, 2 figs., 24 refs. Menasha, Wis., 1948.

The following is substantially the authors' summary. Seven dairy cows were fed on lucerne hay that had been sprayed with 0·25 lb. actual DDT in 5 U.S. gals. water per acre ten days before cutting and bore residues averaging 7–8 parts DDT per million during the period of feeding. The feeding continued for some three months, and after the first few days the amount of DDT in the milk remained steadily at about 2·3–3 p.p.m. [*cf.* also *R.A.E.*, A **36** 393; **37** 346]. Butter made from this milk was found to contain 65 p.p.m. DDT. When half the foodstuff was replaced by untreated hay, the output of DDT in

the milk soon decreased to about two-thirds of its former value. There were no apparent external symptoms in the cows, and milk production was not affected. More information is needed on the effect of low rates of feeding, type of ration, butterfat production, type of cow and the fate of DDT in the cow.

Doucette (C. F.). **Field Parasitization and Larval Mortality of the Cabbage Seedpod Weevil.**—*J. econ. Ent.* **41** no. 5 pp. 763–765. Menasha, Wis., 1948.

The following is based on the author's summary. Observations of cruciferous seed pods in western Washington and western Oregon indicated that numerous larvae of *Ceuthorrhynchus assimilis*, Payk., fail to mature. The percentages that died in the pods were found to be high in many of the important food-plants of the genus *Brassica*, but comparatively low in the genus *Raphanus*; thus they were 94–100 in kohlrabi, 45–64 in cabbage, and only 3–7 in cultivated radish. Many larvae die in the sponge-like tissue between the seeds in the *Brassica* pods, and in kohlrabi, particularly, the nature of this tissue is considered responsible for the almost complete larval mortality. Parasitism is also high in radish pods, there is much less larval movement from seed to seed, as many of the larvae complete their development on single seeds, and they are rarely attacked by parasites. Several parasites caused considerable larval mortality [*cf. R.A.E.*, A **35** 299]. Of these, *Trichomalus fasciatus*, Thoms., *Necremnus duplicatus*, Gah., *Eurytoma* sp. and *Disemiscus* (*Disema*) sp. are common in the Pacific Northwest, and a species of *Trichomalus* differing from *T. fasciatus* was reared in moderate abundance at Sumner, Washington, and Moscow, Idaho.

Patch (L. H.) & Deay (H. O.). **Effect of Plant Development on Resistance of Corn Hybrids to European Corn Borer.**—*J. econ. Ent.* **41** no. 5 pp. 766–769, 4 refs. Menasha, Wis., 1948.

Since the multiple-brood strain of *Pyrausta nubilalis*, Hb., has recently become the dominant form throughout the central maize belt of the United States [*cf. R.A.E.*, A **37** 155], investigations on the effect of plant development on the resistance of hybrids of maize (dent corn) to the second generation were carried out in Indiana in 1944 and 1945. The strains tested were of known degrees of resistance to the June generation. Some of the plants were artificially infested with egg-masses, in addition to the natural infestation, and some of the eggs hatched while the plants were in the silking stage.

In 1944, three or six egg-masses were attached to lightly infested plants of six resistant, five partly resistant and three susceptible hybrids, and the larvae hatched on 4th–11th August, 1–8 days after most of the plants began to show silks. On 9th September, the resistant strains bore an estimated average of 9·5 larvae per plant, the partly resistant 8·7 and the susceptible 10·3. The resistant group silked later than the others, but the data were not adequate to show any effect of this on the averages. The five hybrids that silked less than 33·1 days after 30th June averaged 8·7 larvae per plant and the nine silking later averaged 9·7. Three of the five earliest silking hybrids were in the partly resistant group and one in each of the other groups, which may explain the lower populations in the partly resistant group.

In 1945, a resistant hybrid and a susceptible one were planted on five dates, infested with six egg-masses per plant about 30th June or on 9th August, and dissected during the second week of August or the third week of September, respectively. The numbers of larvae per plant resulting from hand infestation with eggs of the June generation or natural infestation were 0·52 and 0·58 for the resistant hybrid and 1·13 and 1·03 for the susceptible one. These low

levels of infestation indicated a very low rate of survival of larvae, but the susceptible hybrid averaged twice as many as the resistant one, as was expected. Larvae of the August generation were much more numerous on all the artificially infested plantings than on those bearing natural infestations only. In the two latest plantings, on which the larvae hatched a week or less before the plants silked, there were 8·7 per plant on the resistant plants and 12 on the susceptible ones, but on the three early plantings, where the larvae hatched up to 7·6 days after the plants silked, both hybrids averaged 9·9 per plant. Naturally infested resistant and susceptible hybrids of all plantings averaged 0·94 and 2·36 larvae per plant.

The data as a whole indicate that a hybrid resistant to the survival of larvae of the June generation, hatching when the leaves are in the whorl, may be as susceptible as a susceptible hybrid when larvae of the August generation hatch while the plants are silking [*cf.* also **37** 225], and that some hybrids resistant to the June generation may end the season with more larvae per plant than are found on susceptible hybrids because of their greater attractiveness to moths for egg-laying.

GAMBRELL (F. L.). **DDT, Ryania, and Benzene Hexachloride for Control of the Elm Leaf Beetle.**—*J. econ. Ent.* **41** no. 5 pp. 770–773, 3 figs., 2 refs. Menasha, Wis., 1948.

In 1944, a spray of 2·5 lb. 20 per cent. wettable DDT powder per 100 U.S. gals., applied with a power sprayer on 23rd June, gave complete control of larvae of *Galerucella luteola*, Müll. (*xanthomelaena*, Schr.) on American elm [*Ulmus americana*] in New York and a similar spray with a spreader applied on 28th July soon after the adults had emerged caused large numbers to drop from the tree within the first 24 hours and smaller numbers for 14 days [*cf. R.A.E.*, A **36** 143, 336], most of the fallen insects dying within 48 hours. It is considered that most of the beetles collected after the first few days had migrated into the sprayed tree.

In 1945, limited tests with a dust of 10 per cent. DDT in pyrophyllite, applied by an explosive charge from a mortar [*cf.* **33** 46], resulted in large kills of larvae and adults and protected the trees for the remainder of the season. Single applications of sprays containing essentially 1 lb. DDT, 2 lb. ryania (ground roots and stems of *Ryania speciosa*) or 4 lb. lead arsenate per 100 U.S. gals. in June or July, before hatching was complete, gave 94, 90 and 99 per cent. kill of larvae after 14 days, and in 1946, single applications in June, when 60 per cent. of the egg-masses had hatched, of 1 lb. DDT, 1 lb. ryania, 1 lb. wettable benzene-hexachloride powder (3·8 per cent. γ isomer) or 4 lb. lead arsenate per 100 U.S. gals. gave 99, 60, 80 and 52 per cent. kill in ten days. The percentages of eggs containing dead larvae were 10, 9, 39, 3 and 3 for DDT, ryania (1 lb.), benzene hexachloride, lead arsenate and no treatment, respectively.

An aerosol of 5 per cent. DDT in fuel oil, applied on 6th August 1945 with a fog applicator [*cf.* **35** 259] at the rate of 2 U.S. gals. to a Chinese elm [*U. pumila*] 30 ft. high killed large numbers of larvae and adults, though many adults flew from the tree at the time of application ; it caused some yellowing and falling of leaves on part of the tree that received an excessive amount of fog. In preliminary tests in 1947, a spray of 6 lb. 15 per cent. wettable parathion powder per 100 U.S. gals. killed adults within a few hours and gave excellent control of both young and full-grown larvae, and in large-scale operations in one city and one village in the same year, sprays of 2 lb. 50 per cent. wettable DDT powder per 100 U.S. gals. with or without a spreader and adhesive gave satisfactory control with no increase in infestation by Aphids or mites.

GOULD (G. E.). **Insect-Problems in Corn Processing Plants.**—*J. econ. Ent.* **41** no. 5 pp. 774–778, 7 refs. Menasha, Wis., 1948.

The author gives an annotated list of some 50 species of insects and seven of mites collected during the inspection of two maize processing plants in Illinois. None of them was causing serious damage to the grain or grain products, but several were so numerous as to constitute a risk in the production of pure foods. The two factories contained not only the common species attacking stored and processed grain, but also a number attracted to the moist environment peculiar to starch manufacturing plants. Only *Euborellia annulipes*, Lucas, *Drosophila funebris*, F., *Blattella germanica*, L., *Carpophilus nitens*, Fall, and mites, including *Tyrophagus lintneri*, Osb., *Caloglyphus moniezi*, Zkhv., *C. rodionovi*, Zkhv., and *Rhizoglyphus echinopus*, Fum. & Rob., were present in large numbers, and all occurred where the wet processing of maize was carried out. Their control will necessitate thorough sanitation and the repair and replacement of certain old equipment, although the measures normally used keep most of the other pests under control.

ARANT (F. S.). **Preliminary Field Tests with new Insecticides for Control of Velvetbean Caterpillar.**—*J. econ. Ent.* **41** no. 5 p. 803, 1 ref. Menasha, Wis., 1948.

Preliminary tests of new insecticides in dusts against larvae of *Anticarsia gemmatalis*, Hb., were carried out in Alabama in 1946 and 1947. In 1946, when the dusts were applied to lucerne at the rate of 15 lb. per acre, 1 per cent. DDT or γ BHC (benzene hexachloride) was highly effective, but 1 per cent. chlordan was much less so. In 1947, when applied at 25 lb. per acre on soy beans, undiluted cryolite, 5 per cent. DDD (dichlordiphenyldichlorethane) or methoxy-DDT, 1 per cent. parathion or γ BHC, 2 per cent. DDT and 10 per cent. chlorinated camphene [toxaphene] all gave satisfactory control, the organic compounds acting more quickly than cryolite, but 5 per cent. chlordan was not satisfactory.

PHILLIPS (G. L.) & BODENSTEIN (W. G.). **A successful large-scale Experiment in Methyl Bromide Fumigation of bulk Cottonseed for Pink Bollworm Control.**—*J. econ. Ent.* **41** no. 5 pp. 804–805, 1 ref. Menasha, Wis., 1948.

As it had been shown that larvae of the pink bollworm [*Platyedra gossypiella*, Saund.] in cottonseed can be killed by fumigating with moderate dosages of methyl bromide, the possibility of distributing the gas effectively enough to destroy them in a large mass of seed was investigated in three experiments in Oklahoma. The seed was fumigated in a cylindrical tank, 48 ft. high and having a capacity of 56,345 cu. ft., supplied with an air-circulating system that withdrew air from beneath a false floor and returned it at the top and established circulation through a load of 550 tons seed within 5–8 minutes. The distribution of the methyl bromide was studied by putting samples of infested cottonseed at various points throughout the load and by sampling the gas at intervals at several points. In the first test, 15 cages of adults of the flour beetle [*Tribolium*] and larvae of the carpet beetle [*Anthrenus scrophulariae*, L.] were also distributed at intervals. It took about three days to fill the tank with 450–550 tons of seed. When the load had reached the desired level, all openings were sealed and air circulation was established by running the fan for ten minutes before the introduction of the gas. The gas was released from 175-lb. cylinders directly into the circulating system, which took 6–7½ minutes per cylinder, and first appeared at the bottom of the load in 4–6½ minutes. The fan was operated for ten minutes after all the gas had been released to mix it with the air in the tank. At the end of the exposure period, the exhaust vent was

opened and the fan operated for 8–12 hours until no trace of gas was evident in the exhaust stream. Insect samples were removed as the seed was unloaded over a period of 2–3 days.

The methyl bromide was used at rates of 3, 4½ and 6 lb. per 1,000 cu. ft. for 24 hours. Analysis of gas samples showed that at least 55 per cent. of the applied dosage was present at all points tested within one hour and that the concentrations were 31·5–87·5, 50–69·5 and 55–75 per cent. of the applied dosages after two hours and 17·5–58, 15·5–40 and 14·5–45 per cent. after 24 hours in the three tests, respectively. All the treatments gave complete mortality of the insects in all the biological samples.

Breakey (E. P.) & Batchelor (G. S.). **The Orange Tortrix, a Pest of Raspberries in western Washington.**—*J. econ. Ent.* **41** no. 5 pp. 805–806. Menasha, Wis., 1948.

Tortrix (*Argyrotaenia*) *citrana*, Fern., which has been a pest in the orange groves of California for many years and was a greenhouse pest in western Washington before 1933, appeared in raspberry fields near Seattle in that year and has since developed into the most important pest of raspberries in the Puyallup area. It has several generations a year, and the larvae feed on the buds and tenderest leaf growth in winter and tie leaves together in the terminal growths of the cane during the summer. They feed mainly on the foliage, but also attack the flowers and ripening fruit ; objections to their presence in the field arise principally from the fact that they contaminate the fruit in the processing plants. The eggs are deposited in masses of 30–35 on the leaves of the food-plants, and larvae from the same egg-mass are known to develop at greatly different rates, so that the generations overlap. They are known to feed on more than 50 plants, including various weeds and shrubs as well as blackberry, loganberry, strawberry, blueberry, apple, peach, plum, sweet cherry and grape. Overgrown hedgerows and neglected ditch and creek banks are a reservoir from which moths may fly to the neighbouring fields to oviposit.

Tests in 1941 and 1942 showed that cryolite was generally effective against the larvae, though there was a danger of producing a poisonous residue on the fruit. By 1946, the insect had become a serious problem, and in 1947 some of the newer insecticides were tested for its control. They were used in sprays at the rate of 2 lb. 50 per cent. spray powder per 100 U.S. gals. in comparison with cryolite (2 lb. per 100 U.S. gals.) and summer-oil emulsion (1 quart per 100 gals.) was added to all sprays as an adhesive. They were applied on 2nd, 14th and 28th April and 12th May, and counts made on 25th July showed that the numbers of larvae per 560 ft. of row were reduced from 107 for no treatment to 9 for DDD (dichlordiphenyldichlorethane), 18 for cryolite, 19 for dimethoxytrichlorethane [*sic* ? dimethoxydiphenyltrichlorethane (methoxy DDT)], 59 for DDT and 80 for benzene hexachloride (10–12 per cent. γ isomer). The larvae tended to be concentrated towards the ends of the rows nearest an overgrown creek, and many were noted on weeds, particularly *Chenopodium*. More recent experience in the use of DDD, the most promising of the insecticides tested, indicates that it should not be applied with oil, as this has resulted in the development of a chlorosis. DDT damaged the raspberry plants and its use was followed by serious infestation by *Tetranychus willamettei*, McG.

Sherman III (F.) & King (H. L.). **Tests in 1947 against the Two-spotted Spider Mite.**—*J. econ. Ent.* **41** no. 5 pp. 807–808. Menasha, Wis., 1948.

Tetranychus bimaculatus, Harvey, was widespread on fruit trees in Michigan in 1947. It was most abundant on apple, but also occurred on peach, pear and

cherry, and considerable injury to the foliage and fruit was apparent when infestation was heavy.

In tests of sprays applied once at the end of July or in August on apple trees, 2·5 lb. 25 per cent. parathion or 4 lb. 15 per cent. parathion per 100 U.S. gals. killed practically all the mites and, unlike the other materials used, left a residue that killed the new mites as they hatched. A spray of 0·5 pint tetraethyl pyrophosphate with 0·5 pint spreader per 100 gals. gave almost as good initial kill; 1·25 lb. 20 per cent. dicyclohexylamine salt of dinitro-o-cyclohexylphenol per 100 U.S. gals., with ½ lb. aluminium sulphate or alum, which have been found to increase the effectiveness of this salt against the European red mite [*Paratetranychus pilosus*, C. & F.], and 1 pint hexaethyl tetraphosphate with 0·5 pint spreader per 100 gals. were less effective; and bis(parachlorphenoxy) methane at 1·25 or 2·5 lb. per 100 U.S. gals. was ineffective. None of the sprays injured the trees.

Gaines (J. C.) & Dean (H. A.). **Comparison of Insecticides for Control of Harlequin Bugs.**—*J. econ. Ent.* **41** no. 5 pp. 808–809, 2 figs., 1 ref. Menasha, Wis., 1948.

Large numbers of adults of *Murgantia histrionica*, Hahn, emerge from hibernation early in April in central Texas and severely injure such crops as cabbage and turnip. Their control, which would protect the crops and eliminate later broods, has proved difficult, and various insecticides were therefore tested against them in 1947 and 1948.

In laboratory tests, adult bugs were dusted with various amounts of each material and immediately transferred to clean jars, kept at temperatures of 75–85°F. and 60–70 per cent. relative humidity and given clean food each day for five successive days. BHC (benzene hexachloride) and parathion were very toxic even at concentrations as low as 0·5 per cent. γ isomer and 0·25 per cent., respectively, and chlordan and chlorinated camphene [toxaphene] were more toxic than DDT or sabadilla, all at 10 per cent. The median lethal doses of these dusts were 4·8, 8·6, 5·1, 8·7, 12·2 and 14·9 lb. per acre. BHC showed the quickest action, and toxaphene the slowest.

In cage tests, plants were dusted and then infested in 1947, and both plants and insects were dusted in 1948. All dusts except 25 per cent. sabadilla were applied at 16 lb. per acre. Good control was given in 1947 by 10 per cent. DDT or toxaphene and by a BHC dust containing 4·3 per cent. γ isomer, but not by 10 per cent. sabadilla, and effective though less good control in 1948 by 10 per cent. toxaphene, 1 per cent. parathion, and BHC dust (3 per cent. γ isomer) but not by 10 per cent. DDT or chlordan or 25 per cent. sabadilla, which was applied at 11 lb. per acre. Neither DDT nor toxaphene was as effective in 1948 as in 1947, possibly because the relative humidity was low.

In a field test on swedes, the dusts were applied with rotary hand guns after a shower early in the morning while the air was calm and dew present; dew formed each morning throughout the observation period. Dusts of 10 per cent. DDT or toxaphene or 20 per cent. sabadilla applied at 44, 36 and 46 lb. per acre, respectively, gave 91·8, 96·7 and 80·6 per cent. reduction of adults in five days and 99·1, 98·4 and 98·8 per cent. of nymphs.

Gaines (J. C.) & Hanna (R. L.). **Comparison of Diluents in Insecticide Mixtures for Cotton Insect Control.**—*J. econ. Ent.* **41** no. 5 pp. 811–812. Menasha, Wis., 1948.

Since increases in red spider mites [*Tetranychus*] on cotton in Texas were not prevented by certain organic insecticides diluted with clay, talc or pyrophyllite, but did not occur when the mixtures contained at least 40 per cent. sulphur,

the effects of several mixtures containing pyrophyllite and sulphur on *Anthonomus grandis*, Boh., *Heliothis armigera*, Hb., *Aphis gossypii*, Glov., and the mites were compared in 1947.

Dusts containing 3 per cent. γ BHC (benzene hexachloride) with 5 per cent. DDT and 40 per cent. pyrophyllite or sulphur, 20 per cent. chlorinated camphene [toxaphene] with 40 per cent. pyrophyllite or sulphur, or calcium arsenate with 33·3 per cent. pyrophyllite or sulphur and pyrophyllite and sulphur alone were applied on 11th and 23rd June against *Anthonomus* and six times between 4th and 29th July against *Anthonomus* and *Heliothis*. The three insecticides were equally effective against *A. grandis*, whatever the diluent, and significantly more effective than the diluents alone. All were significantly better than the diluents alone against *H. armigera*, and the mixtures containing BHC and DDT were significantly better than calcium arsenate, these being the only significant differences between treatments. The Aphid population was significantly higher for calcium arsenate than for pyrophyllite alone, and a little lower for sulphur alone than for pyrophyllite and for the mixtures containing the organic insecticides than for sulphur. The mite populations were about the same on plots treated with the organic insecticides mixed with pyrophyllite but much lower on those treated with sulphur alone or in the mixtures. Yields were significantly higher on plots treated with the BHC-DDT dust or toxaphene than on those treated with calcium arsenate and were unaffected by the different diluents.

Wolcott (G. N.). **Collecting Parasites of White Grubs for Puerto Rico: then and now.**—*J. econ. Ent.* **41** no. 5 p. 813, 2 refs. Menasha, Wis., 1948.

The author ponts out that modern means of transport enable entomologists engaged in the introduction of parasites to obtain results that were impossible when it was necessary to ship inactive stages in cold storage, since the speed of aeroplane express services now makes it possible to collect, carry and release adult insects within such a short time that mortality is negligible. He illustrates this by showing the change in methods of introducing Scoliids of the genus *Tiphia* into Porto Rico [*cf. R.A.E.*, A **11** 60, etc.] for release against white grubs [chiefly species of *Cnemarachis* (**31** 88)].

Before the introduction of *Bufo marinus* into Porto Rico in 1920 and 1923 and its establishment and rapid spread throughout the coastal regions, white grubs were the most important insect pest on the island, and the reappearance of injury by them during the last few years reflects the first drop in the abundance of this toad [*cf.* **25** 441] and has necessitated the consideration of other natural means of control. In 1912–14, *Tiphia* cocoons were sent from Illinois to Porto Rico by way of New York in cold storage, but owing to the differences in host and environment for such specialised insects, these introductions failed even when the difficulties of collection and transport had been solved. The optimum total emergence from the cocoons from Illinois was 79 per cent., but no living adults were obtained from some shipments. White grubs are of minor importance in Cuba and Hispaniola, and the discovery of large numbers of *T. hispaniolae*, Wolc., in the mountains of Haiti [*cf.* **27** 84] indicated one possible cause of white-grub scarcity in the larger West Indian Islands. Between 26th November and 6th December 1946, 148 adult females were collected feeding on the nectar of wild carrot at Kenscoff, Haiti, sent by air express to San Juan, Porto Rico, in four shipments and liberated at Rio Piedras and Isabela, usually within 24 hours of being collected. The total mortality of adults, including some that had been kept for a day or two before shipment, was only 6 per cent. It is emphasised that even if the existence of the Haitian *Tiphia* had been known 35 years ago, its introduction into Porto Rico would have been virtually impossible, owing to transport difficulties.

Douglass (J. R.), Gibson (K. E.) & Hallock (H. C.). **Reducing Curly Top Infection with Insecticides.**—*J. econ. Ent.* **41** no. 5 p. 814, 1 fig., 2 refs. Menasha, Wis., 1948.

To determine whether sugar-beet of a variety highly susceptible to the virus of curly-top could be protected from the disease by applications of DDT when the vector, *Circulifer* (*Eutettix*) *tenellus*, Baker, was abundant, a small field in the most heavily infested part of Idaho was planted with a non-resistant variety on 27th March 1947, so that the plants would be in the seedling stage, the period of greatest susceptibility, when the spring migration of the leafhopper was at its peak. The plants began to show about 10th April, and they were thinned on 14th–15th May. The field was dusted with 10 per cent. DDT in pyrophyllite twelve times between 22nd April, when leafhoppers were already present, and 12th June, at 14–32 lb. per acre. Examination on 26th July showed that 37 per cent. of the plants were infected with the virus, but very few died from the disease during the season. Counts of plants on 27th October showed an average stand of 95 per cent., and a yield of 21·7 tons per acre was obtained. In a field in a neighbouring area there were 16 leafhoppers per plant at the peak of the spring movement into beet fields, and about 31 per cent. were carrying the virus of curly-top, but commercial fields of beets were planted with varieties that are resistant to the virus except during the early stages of growth, and were infested with leafhoppers too late for maximum infection ; about 18 per cent. of plants were infected and the average yield was about 17 tons per acre. Damage was severe on susceptible crops, 98 per cent. of tomato plants in commercial plantings near the test plot being killed by curly-top.

It is concluded that, in view of the drastic exposure in a season unfavourable for insect control, the treatment gave good protection from infection, though it is not practical to make so many applications and the resulting accumulations of DDT in the soil over a period of time might be detrimental. Unusually frequent rains were partly responsible for the large number of applications, as the dust was often washed off on the day it was applied. The results obtained are considered to be too preliminary to form a basis for recommendations.

Dobbins (T. N.) & Fronk (W. D.). **Insecticide Tests for the Control of Coleopterous Larvae attacking Peanuts in the Soil.**—*J. econ. Ent.* **41** no. 5 pp. 815–816, 1 ref. Menasha, Wis., 1948.

Diabrotica undecimpunctata howardi, Barber (*duodecimpunctata*, auct.) is at present the most injurious of the insects that damage the pods of groundnuts in the soil in Virginia [*R.A.E.*, A **36** 337], but they are also injured by the larvae of other Lamellicorns, mainly *Strigoderma arboricola*, F. [**35** 250], and by wireworms. Grayson & Poos showed that injury by *Diabrotica* could be reduced by soil treatment with DDT and also by application of DDT to the foliage against the tobacco thrips, *Frankliniella fusca*, Hinds [erroneously cited as *Thrips tabaci*, Lind., in the abstract of their paper (**36** 338)].

In tests in 1947, BHC (benzene hexachloride) applied to the soil at 0·5 or 1 lb. γ isomer per acre and worked into the top 1–2 inches and DDT similarly applied at 25, 50 and 100 lb. per acre on 24th June or 14th July significantly reduced injury to pods by *Diabrotica* in practically all cases but not that by the other larvae. There were no significant differences in yield, but this result may not be dependable because of the small areas involved. It is concluded that a minimum of 1 lb. γ BHC or 100 lb. DDT per acre would be required for practical control by soil treatment. The higher dosages did not appear to affect the growth of the plants and they markedly reduced the injury to the foliage by *F. fusca* ; the flavour of the groundnuts was not affected by the BHC.

In other tests in which various sprays and dusts were applied to the foliage primarily against *F. fusca* on 12th, 18th, 20th and 30th June, there were marked

differences in injury to pods by Coleopterous larvae between sprayed and untreated plots but not between dusted and untreated plots. Examination on 3rd October of pods from sprayed plots showed that the reductions of injury by *Diabrotica* and by other larvae were both highly significant for BHC (0·1 per cent. γ isomer), and significant for 0·1 per cent. chlordan or 4 per cent. DDT, all in emulsified solutions, but that wettable-powder sprays containing 0·05 per cent. parathion or 0·1 per cent. chlorinated camphene [toxaphene] had been ineffective, possibly owing to poor coverage.

In the first test, the pod injury caused by larvae other than *Diabrotica* was mainly attributed to *S. arboricola*, whereas in the second about half of it was due to wireworms.

GRAYSON (J. M.). **Germination of fumigated Peanuts.**—*J. econ. Ent.* **41** no. 5 pp. 816–817. Menasha, Wis., 1948.

The results are given of investigations in Virginia in 1945 on the germination of groundnuts fumigated with chlorpicrin. Maize was included for comparison, and the concentrations tested were equal to those normally used and higher. Preliminary tests indicated that shelled groundnuts were more affected by fumigation than unshelled ones and that the moisture content of the seed was more important than either temperature or length of exposure. In Tidewater, Virginia, the moisture content of groundnuts stored on farms was about 6–12 per cent. between early December and late April, whereas that of maize was 15·3–22 per cent. soon after harvest and about 14·5 per cent. during the winter and early spring. When shelled groundnuts were subjected to six different concentrations of chlorpicrin ranging from 1 lb. to 10 lb. per 1,000 cu. ft. for 24 hours at an average temperature of about 72°F., there was very little reduction in germination at rates up to 6 lb. and no serious reduction at rates up to 10 lb. when the moisture content was below 10 per cent., but slight reduction at 2 lb. and considerable reduction at higher rates at moisture contents greater than 14 per cent. For the same exposure period and average temperature, the germination of maize seed showed very little reduction at rates up to 8 lb. per 1,000 cu. ft. when the moisture content remained below 14 per cent., but was affected at 1 lb. and seriously reduced at 2 lb. when the moisture content exceeded 19 per cent.

A concentration of 1–3 lb. chlorpicrin per 1,000 cu. ft. for 24 hours is usually recommended, and these preliminary data indicate that either shelled or unshelled groundnuts can be fumigated at these rates without reduction in germination, provided that the moisture content does not exceed 10 per cent., and that shelled groundnuts appear to be as resistant as maize seed with comparable moisture contents to injury from chlorpicrin.

DENNING (D. G.). **Aphid Control with Hexaethyl Tetraphosphate.**—*J. econ. Ent.* **41** no. 5 p. 817. Menasha, Wis., 1948.

During late August and early September, some willow trees about 30 ft. high at Laramie, Wyoming, were severely infested by *Pterocomma smithiae*, Monell. A spray of 1 pint hexaethyl tetraphosphate per 100 gals. water, applied with a high-pressure sprayer at the rate of about 10 U.S. gals. per tree in the morning under cool, partly cloudy conditions, gave practically complete control of both winged and wingless Aphids in 4½ hours and killed insects of 25 other species, a list of which is given. Only three living Aphids could be found the next day and only one the day after. The man who applied the spray had both hands wet with the solution but suffered no adverse effects, and there was no spray injury to the trees.

Dudley jr. (J. E.), Bronson (T. E.) & Stone (P. V.). **Tetraethyl Pyrophosphate, Parathion and Benzene Hexachloride to control the Pea Aphid.**—*J. econ. Ent.* **41** no. 5 p. 817. Menasha, Wis., 1948.

In 1947, DDT, TEPP (tetraethyl pyrophosphate), parathion and BHC (benzene hexachloride) were compared with derris in dusts for the control of *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) on canning peas in Wisconsin. A solution of technical DDT in a non-volatile solvent was sprayed on talc to give a concentration of 1·25 per cent. technical DDT ; parathion was mixed with a clay (aluminium magnesium silicate) to give a concentration of 0·5 per cent. and TEPP, derris and BHC with talc to give concentrations of 2·5 per cent. TEPP, 0·6 per cent. rotenone and 0·85 per cent. γ isomer, respectively. All dusts were applied late in June at the rate of 35 lb. per acre ; the TEPP dust was prepared on the day of application and the others several weeks before.

There were no significant differences in control after 1–3 days between TEPP, parathion, DDT and derris (96, 92, 90 and 85 per cent. reduction in infestation), but all were significantly better than BHC (65 per cent.). The maximum benefit derived from derris and DDT could not be determined in the three-day period of observation.

Wolfenbarger (D. O.). **Nutritional Value of phosphatic Insecticides.**—*J. econ. Ent.* **41** no. 5 pp. 818–819, 3 refs. Menasha, Wis., 1948.

The new phosphorus insecticides appear to have caused increases in yield of potatoes that may be due to something other than their action on insect pests, and evidence was obtained in 1947 and 1948 that part of the increase may be due to nutritional effects. It was obtained from regular field-plot experiments on potato in southern Florida, in which *Liriomyza pusilla*, Mg., was the most injurious insect present and *Myzus persicae*, Sulz., became abundant each year. A fungicide consisting of 2 U.S. quarts disodium ethylene bisdithiocarbamate with 1 lb. zinc sulphate per 100 U.S. gals. water was applied against late blight [*Phytophthora infestans*] to all plots, including the controls, and the experimental materials were mixed with it ; ½ lb. hydrated lime per 100 U.S. gals. was added in 1947 but was found unnecessary and omitted in 1948. The sprays were applied at intervals of 5–15 days, beginning when the plants were 4–10 days old. In 1947, when a total of approximately 1,100 U.S. gals. per acre was used in six applications, an insecticide containing 50 per cent. hexaethyl tetraphosphate in inert material gave 3, 19 and 35 per cent. control of leaf mines and 25, 64 and 65 per cent. control of Aphids at concentrations of ½, 1 and 2 pints per 100 gals., and significant increases in yield (13 per cent.) at the two higher concentrations.

In the two experiments in 1948, the phosphorus compounds (and DDT in the second test) were applied in nine of 11 fungicide applications, and approximately 1,000 U.S. gals. per acre was used in these nine. In the first experiment, parathion at 2 lb. 25 per cent. wettable powder per 100 U.S. gals. gave 93 and 83 per cent. control of leaf miners and Aphids, respectively, as compared with 19 and 69 per cent. for an insecticide containing 9 per cent. tetraethyl pyrophosphate and 14 per cent. other organic phosphates at 1 pint per 100 gals. and 39 and 63 per cent. for 95 per cent. tetraethyl pyrophosphate at ½ pint per 100 gals. All three increased the yield by about 19 per cent.

In the second experiment, which was termed a nutritional test because phosphoric acid, which could not be expected to give any control of the insects, was used in it, the addition to the fungicide of DDT (2 lb. 50 per cent. wettable powder per 100 U.S. gals.), alone and with 1 U.S. pint of the insecticide containing 9 per cent. tetraethyl pyrophosphate, and with 1 U.S. pint 75 per cent. phosphoric acid gave no control of *Liriomyza*, 86, 96 and 82 per cent. control of the Aphid and increases in yield of about 8·5, 15 and 25 per cent., respectively.

The yield differences were not quite enough for statistical significance, but are considered indicative; moreover, the plants that received the phosphorus compounds were the last to fade, and it is concluded that the latter acted as nutrients to them. The various phosphorus compounds appeared to have no effect on the control of late blight by the fungicide; the hard water used in the sprays may have reduced their insecticidal effectiveness, since they are considered to decompose more rapidly in alkaline media.

EIDE (P. M.). **A Tip-infesting Sawfly on Rose.**—*J. econ. Ent.* **41** no. 5 pp. 819–821, 2 figs., 2 refs. Menasha, Wis., 1948.

Injury observed in May 1940 to the growing tips of Manetti rose, which is grown for root stocks in the Puyallup Valley, Washington, was found to be due to small sawfly larvae in the stems. Adults reared from these were identified as *Ardis sulcata*, Cam., which has been recorded from several countries in Europe [*cf. R.A.E.*, A **21** 267], but not previously from the United States. The larvae did not appear to be numerous or very injurious in 1940, but examination of commercial plantings of Manetti rose in the spring of 1941 revealed many similarly damaged tips, and the insect was found generally on wild rose in the Puyallup Valley. The destruction of the growing tips caused excessive branching of the shoots and made them unsuitable for propagation. Infestation of ornamental roses seemed to be rare, only three cases having been noted in which the larvae bored into flower buds, and no attack on other varieties of roses grown for root stocks was observed, even when they were adjacent to heavily infested Manetti rose. Damaged tips, adults or larvae were observed on wild rose in seven counties in Washington and in two in Oregon, but damage to commercially grown Manetti rose was observed only in two counties of Washington.

The eggs are laid in the leaflets while these are still in the bud and hatch in about a week, soon after the first leaves unfold. The larvae crawl down the petioles and devour the small tender leaves still in the buds, after which they bore into the ends of the stems for an inch or less. One egg is usually laid in a bud, but as many as four have been found, and three small larvae have been found in a single tip, though only one reaches maturity in each tip. The larvae become fully fed in about a month and then make small holes through the bark at the bottom of their burrows, drop to the ground, and form hibernation cells 1–3 inches below the surface. They pupate in the spring and the pupal period is short. There seems to be only one generation in the year, but the adults oviposit on every warm day from the beginning of April until June. Adults were first seen in the field on 28th March, in 1942, and eggs were still present on 16th June. A species of *Habrocytus* was abundant in 1941, when it killed 30 per cent. of the larvae in Manetti rose in the Puyallup Valley, and single examples of *Ephialtes* (*Epiurus*) *euurae*, Ashm., and *Lathrolestes* sp. were also reared from larvae.

KNOWLTON (G. F.) & NYE (W. P.). **Insect Food of the Vesper Sparrow.**—*J. econ. Ent.* **41** no. 5 p. 821. Menasha, Wis., 1948.

The authors give a list of the recognisable insects found in the stomachs of 116 western vesper sparrows (*Pooecetes gramineus confinis*) collected throughout Utah in 1934–45. Most of those that could be identified were injurious, although a very few beneficial forms were present.

SHAW (F. R.), BAILEY (J. S.) & BOURNE (A. I.). **Biology and Control of a *Lecanium* attacking cultivated Blueberries.**—*J. econ. Ent.* **41** no. 5 p. 822. Menasha, Wis., 1948.

A considerable outbreak of a Coccid tentatively identified as *Eulecanium* (*Lecanium*) *quercifex*, Fitch, which has been recorded as a pest of oaks in Canada,

New York and Massachusetts, has occurred on cultivated blueberries at Amherst, Massachusetts, during the last few seasons. Counts made in the early spring of 1947 and subsequently showed that the winter mortality averaged practically 75 per cent. In laboratory tests before the spraying season, infested cuttings sprayed with standard dosages of dormant oil, 25 per cent. DDT emulsion concentrate or an unspecified dinitro compound showed 92·9, 96·4 and 95·7 per cent. nymphal mortality after eight days, as compared with 72·5 per cent. for no treatment. As soon as weather and ground conditions allowed, the infested area was sprayed. Untreated plants and those sprayed with dormant oil, DDT emulsion and the dinitro compound showed 77·5, 98·3, 90·4 and 98·2 per cent. nymphal mortality, respectively, after eight days.

On the untreated plants, most of the nymphs matured during June. Eggs hatched by 7th July, and crawlers were observed on the leaves on 16th July. It was obvious at this time that very adequate control had been secured on the bushes sprayed with the dormant oil and the dinitro compound. By late July, foliage on untreated bushes and those sprayed with DDT had begun to show considerable blackening by sooty fungus. Final counts of nymphs on 23rd September showed 99·8, 99·9 and 21·16 per cent. fewer per leaf on plants treated with dormant oil, the dinitro compound and DDT than on untreated ones, and in late autumn, untreated bushes and those sprayed with DDT were very heavily infested, whereas those treated with the other two sprays were practically free from the scale.

KULASH (W. M.). **Dust Treatments for Fall Armyworm Control in North Carolina.**—*J. econ. Ent.* **41** no. 5 pp. 822–823. Menasha, Wis., 1948.

Laphygma frugiperda, S. & A., is an annual pest of maize, grasses and leguminous crops in North Carolina, but does not reach epidemic proportions every year. In 1947, it severely damaged lucerne, clover, *Lespedeza* and various grasses; the mounds left by the larvae when they burrowed into the soil to pupate were conspicuous on lawns and golf greens. A mash of 5 lb. paris green in 100 lb. bran, broadcast over one heavily infested field of ladino clover [*Trifolium repens latum*] on 11th September, did not reduce larval activity, but in another in which dusts were applied at 10 lb. per acre and ten larvae were examined from each plot one and two days later, the numbers found living were 10 and 10 for no treatment, 10 and 5 for 5 per cent. chlordan, 2 and 1 for 3 per cent. γ BHC (benzene hexachloride) with 5 per cent. DDT and 3 and 3, with one moribund each time, for 20 per cent. chlorinated camphene [toxaphene]. All three dusts gave effective control, as young shoots were not attacked after they were applied, but the mixture of DDT and BHC was evidently the most rapid and efficient in action. The dusts caused no injury to the plants. In other fields in which the armyworm was attacking large areas of clover or lucerne pasture, aeroplane dusting with 5 per cent. DDT at 30–35 lb. per acre reduced the infestation and the damage to the plants. One application of the dust of BHC and DDT also controlled *L. frugiperda* on lawns and golf greens, and a heavy infestation by larvae of *Cotinis nitida*, L., in a lawn.

LANGFORD (G. S.) & CORY (E. N.). **Host Preference in Japanese Beetles with special Reference to Grape and Apple.**—*J. econ. Ent.* **41** no. 5 pp. 823–824. Menasha, Wis., 1948.

The authors state that although the foliage of grape vine and apple is normally considered to be the preferred food of adults of the Japanese beetle [*Popillia japonica*, Newm.], the damage to different varieties may vary from complete defoliation to negligible feeding under identical conditions, and give lists of

numerous varieties of these crops grown in the United States, grouped according to their attractiveness or otherwise to the beetles. The factors responsible for the variation in attractiveness are not known, but the character of the foliage of vines seemed to be of some importance, varieties having thin, glossy and tender leaves being much more severely injured than those with coarse foliage covered with a tomentum.

DAHMS (R. G.). **Comparative Tolerance of small Grains to Greenbugs from Oklahoma and Mississippi.**—*J. econ. Ent.* **41** no. 5 pp. 825–826. Menasha, Wis., 1948.

The following is substantially the author's summary. Pot tests were made in Oklahoma in the winter and spring of 1946–47 to determine the comparative tolerance under greenhouse conditions of 15 varieties of small grains to *Toxoptera graminum*, Rond., from Oklahoma and from Mississippi. Barley plants of the Reno variety made less growth under infestation and were killed in significantly less time by the Oklahoma Aphids than by those from Mississippi, but none of the other varieties showed significant differences in these respects. On three varieties of barley, two of wheat and one of oats, there was no statistically significant difference in fecundity between Aphids from the two States, but on Denton wheat the larger number of offspring produced by the Aphids from Mississippi was highly significant. Although the Aphids from Mississippi lived considerably longer and were more prolific on Mignon barley and Tennex oats than the Oklahoma Aphids, and also lived longer on Denton wheat, these differences were not significant.

WENE (G. P.). **A Helicopter for Vegetable Insect Control.**—*J. econ. Ent.* **41** no. 5 pp. 831–832. Menasha, Wis., 1948.

A helicopter was used in three demonstration tests for the control of pests of vegetables in Texas. In the first, 3 per cent. γ BHC (benzene hexachloride) was applied at the rate of 20 lb. per acre to part of a field of turnips about ten inches high that were heavily infested by *Rhopalosiphum pseudobrassicae*, Davis. The helicopter was flown about 6 ft. above the plants and discharged the dust in 45-foot swathes. The dust was driven in a cloud along the ground for about 30 ft. away from each side of the helicopter, and a thin cloud drifted another 10 ft. The average numbers of Aphids per leaf 24 hours later in parts of the field showing Aphid injury and no Aphid injury were reduced from 49·1 and 75·6 on untreated plants, respectively, to 2·5 and 3·5 on treated ones.

In the second test, a dust containing 5 per cent. hexaethyl tetraphosphate applied to a field of broccoli at 40 and 50 lb. per acre in 40-ft. swathes from a helicopter flying 5 ft. above the plants reduced the numbers of living examples of *Brevicoryne brassicae*, L., per 100 plants from 49·5 to 7 and 5·5, respectively, in the heads and from 9·5 to 1 and 2 on the leaves within 24 hours. Aeroplane applications by growers of a 3 per cent. γ BHC dust at 30 lb. per acre had proved unsuccessful.

In the third, in which broccoli was treated with a 1 per cent. impregnated DDT dust applied in 60-ft. swathes from an aeroplane and in 48-ft. swathes from a helicopter, there were 37 and 67 larvae of *Trichoplusia ni*, Hb., per 20 plants on the two plots the day before treatment and none and two, three days after it ; although the aeroplane appeared to give better control, the difference between the two treatments was not significant. The helicopter blew some of the plants near the machine so much that the tops almost touched the ground.

Brindley (T. A.), Schopp (R.) & Hinman (F. G.). **Field Tests versus Laboratory Tests with DDT against the Pea Weevil.**—*J. econ. Ent.* **41** no. 5 pp. 832–833, 2 refs. Menasha, Wis., 1948.

Although DDT showed little toxicity to *Bruchus pisorum*, L., in laboratory tests [*R.A.E.*, A **32** 383], it proved very effective in subsequent field experiments on peas in Idaho. In 1944, dusts containing 0·75 per cent. rotenone and 5 per cent. DDT reduced the Bruchid populations by 98·2 and 99·2 per cent., respectively, in two days, and in 1945, 2·5, 5 and 10 per cent. DDT in pyrophyllite applied at 20 lb. per acre all did so by 99·3 per cent., whereas a dust containing 0·75 per cent. rotenone reduced them by 97·8 per cent. In 1946, experiments were made to determine how long DDT would remain effective under field conditions, the minimum concentration of DDT that would control the Bruchid and the most effective rate of application of the dust. When applied at 20 lb. per acre, 2·5 per cent. DDT was significantly better than 1·25 per cent., but not significantly different from 5 per cent. DDT, and when the 5 per cent. dust was applied at 10, 20 and 40 lb. per acre, there was little difference in control between the 20- and 40-lb. rates, and the difference between the lowest rate and the others was due primarily to the fact that there was less reduction in the number of Bruchids on the first day after dusting. All three mixtures were superior to 1 per cent. rotenone and had a more persistent effect. There were indications that the DDT treatments were losing their effectiveness on the sixth day, but increases in population were too small to be significant. Additional information obtained in 1947 showed that 5 per cent. DDT applied at 20 lb. per acre was more effective than 1·25, 2·5 or 5 per cent. DDT applied at 10 lb. per acre, but the differences were not significant. The 5 per cent. dust applied at 20 lb. per acre also gave better results than 2·5 per cent. DDT applied at 20 and 40 lb. per acre. The reason for the discrepancy between laboratory and field results is not known, but laboratory tests are evidently not always indicative of the performance of an insecticide in the field.

Lyle (C.) & Fortune (I.). **Notes on an imported Fire Ant.**—*J. econ. Ent.* **41** no. 5 pp. 833–834. Menasha, Wis., 1948.

An ant that interfered with commercial hay production by building mounds 2–3 ft. in diameter and height in meadowland in the vicinity of Artesia, Mississippi, was identified as *Solenopsis saevissima* var. *richteri*, Forel. This ant, which is native to Argentina, was introduced into the United States some time before 1920 at Mobile, Alabama, and until 1947 was recorded only from Mobile and Baldwin Counties, Alabama, and George and Jackson Counties, Mississippi, but surveys made in 1947 showed that it was present in seven additional counties in Mississippi. The mounds are built chiefly along ditches or in low spots near water. The ants live near the top of the mound during the winter but go below ground level in the hottest part of the summer, and the brood nest is usually near the centre of the mound and is moved up or down as the soil water level rises or falls. Preliminary observations in an unheated laboratory during late October and November indicated that the larval and pupal stages lasted about one month and 25 days, respectively.

The ants prefer meat, bread and other foods containing grease or proteins when they invade houses, and were observed attending mealybugs, which was the only evidence of attraction to sweet materials. In George County, they destroyed a large field of maize just as the grains sprouted by feeding on the germ. Injury to the bark of young *Citrus* trees at ground level has also been observed, and the killing of farm livestock at birth has been reported. The ant is very aggressive and stings viciously and is reported to be so prevalent in potato fields near Mobile as to make it difficult to secure labour for harvesting.

Dusts containing 10 per cent. DDT, 5 per cent. γ BHC (benzene hexachloride), 25 per cent. chlorinated camphene [toxaphene] or 5 per cent. chlordan were found to be very effective against the ant in laboratory tests and in field tests in which they were blown through the tunnels in the mounds with a small plunger duster having a short spout to penetrate the outside crust. In extensive field tests, 5 per cent. chlordan was more effective than 10 per cent. DDT, and preliminary tests with calcium cyanide and other fumigants indicated that these were not quite so effective as the chlorinated hydrocarbons. Late winter or early spring seemed to be the best time for applying the dusts, as the ants were then concentrated near the tops of the nests.

ROSENSTIEL (R. G.). **Laboratory Effects of Parathion on the Two-spotted Mite.**—*J. econ. Ent.* **41** no. 5 pp. 835–836. Menasha, Wis., 1948.

In greenhouse tests in Oregon, sprays containing 1 lb., 4 oz. and 1 oz. 15 per cent. wettable parathion per 100 U.S. gals., applied on 6th December to young sweet-pea plants that had been infested with *Tetranychus bimaculatus*, Harvey, four days before, gave 94, 69 and 63 per cent. control in three days. Plants that had been treated with the strongest spray and were not reinfested showed 98 and 100 per cent. control of active and resting stages of the mite after one week and 98 and 73 per cent. after two (when the eggs found were shrivelled and dry), and those that were reinfested on 9th and 16th December, respectively, showed 77 and 66 per cent. control of active mites four days later. Only a few mites in the resting stage were observed on the plants, but the results indicated that they were also susceptible to the parathion residue.

CARLSON (F. W.). **Tests of Toxicants for the Peach Silver Mite.**—*J. econ. Ent.* **41** no. 5 p. 836. Menasha, Wis., 1948.

Vasates cornutus, Banks, was present in every peach orchard examined by the author in the Yakima Valley of Washington, the infestation varying from a few to several hundred mites per leaf. In early autumn (1st September in 1947) the mites move from the leaves to the fruit and leaf buds, where they spend the winter. Severely infested buds are either killed or become too weak to produce fruit. Early in the spring, the mites feed on the blossoms, young peaches and leaves, but no damage to the young peaches has been noted, since these are protected by their pubescence, which appears to afford some nutriment to the mites. Tests in which small branches on a heavily infested tree were sprayed on 18th July and examined on 21st and 22nd July showed that the numbers of mites per leaf were reduced from 395 for no treatment to 0 for 1 U.S. pint of a material containing 9 per cent. tetraethyl phosphate, probably pyrophosphate, and 16 per cent. other organic phosphates, 0·3 for 1 U.S. pint nicotine sulphate, 1 for 1 lb. 15 per cent. parathion and also for a mixture of 2 U.S. quarts disodium ethylene bisdithiocarbamate, 0·5 lb. hydrated lime and 1 lb. zinc sulphate, 1·8 for 1 U.S. gal. lime-sulphur, 21·5 for 1 U.S. pint chlorinated camphene [toxaphene] and 24·5 for 1 lb. bis(parachlorphenoxy) methane, all per 100 U.S. gals. On 24th July, the same tree was sprayed with 1 lb. 15 per cent. parathion per 100 U.S. gals., and on 28th July no living mites were found on it. On 12th August, the untreated tree averaged 495 living mites per leaf and the sprayed one 13. These mites may have hatched from eggs that were present at the time of spraying or have been carried by wind or birds from adjoining trees. No injury to fruit or foliage was caused by any of the materials tested.

Hayes (W. P.) & Liu (Yu-Su). **Tarsal Chemoreceptors of the Housefly and their possible Relation to DDT Toxicity.**—*Ann. ent. Soc. Amer.* **40** no. 3 pp. 401–416, 63 figs., 15 refs. Columbus, Ohio, 1947.

The following is based on the authors' summary. A detailed histological study was made of the tarsi of adults of *Musca domestica*, L., which are very susceptible to DDT poisoning, adults of *Blattella germanica*, L., and adults and larvae of *Epilachna varivestis*, Muls., which are less susceptible. The cuticula, hypodermis and basement membrane form the wall, while the trachea, an unguitractoral tendon and a pair of nerves occur within and run throughout the tarsal segments. On the cuticula, there are several kinds of appendages, such as the spines, fixed hairs, tactile setae, tenent hairs and chemoreceptive setae.

Among the three species studied, chemoreceptive sensillae were found only on the tarsi of *M. domestica*. They are situated lateroventrally on the second to fifth tarsal segments and were not found either on the dorsal side of those segments or on the first tarsal segment. The chemoreceptive organ is composed of a group of sense cells situated in a sub-epidermal position and covered by a nucleated neurolemma continuous with that of the longitudinal nerve. The individual cells are more or less spindle-shaped. The sensillae are attached at the distal end to a long, thin-walled chemoreceptive seta.

The thickness of the cuticula was 12·5–25 μ in *M. domestica*, 25–45 and 15–40 μ in adults and larvae of *E. varivestis*, and 60–90 μ in *B. germanica*. Thus, it may be said that in general *M. domestica*, which is highly susceptible to DDT, has a thinner cuticula than the less susceptible species tested.

Munson (S. C.) & Yeager (J. F.). **The Relation between Poison Concentration and Survival Time of Roaches injected with Sodium and Potassium Cyanides and Potassium Ferricyanide.**—*Ann. ent. Soc. Amer.* **40** no. 3 pp. 475–488, 2 figs., 5 refs. Columbus, Ohio, 1947.

The following is substantially the authors' summary. The relation between concentration and survival time and between concentration and recovery time was studied for large nymphs of *Periplaneta americana*, L., into which solutions of sodium cyanide, potassium cyanide or potassium ferricyanide had been injected. The potassium salts facilitated haemorrhage, thereby increasing experimental error. The course of symptoms in the poisoned cockroaches was compared with that in cockroaches poisoned with sodium metarsenite, which was used as a standard. The curves obtained by plotting time after injection against symptomatic stages of incapacity are complicated in the case of the cyanides by the fact that these compounds have both a narcotic and a lethal effect upon the insects into which they are injected. Whereas deterioration in the condition of cockroaches into which arsenite has been injected is progressive from the onset of symptoms until death, cockroaches into which cyanide has been injected may become completely inactivated (narcotised), recover partly or completely and eventually die after showing a succession of symptoms. The cyanides produce tremors temporarily, particularly during the early stages of poisoning. The curve obtained when concentration of a cyanide is plotted against survival time is complicated not only by the occurrence of both narcotic and lethal effects but also by the existence of two critical zones, one for narcosis and one for death, and by the presence of a region of inflection analogous to the inflection in curves for cockroaches into which arsenite has been injected [*cf. R.A.E.*, A **33** 64; **35** 116]. Thus, these cyanide curves are composite, representing time for complete narcosis at the upper concentrations and survival time at the lower lethal concentrations.

At the intermediate concentrations, they are transitional. These complexities render mathematical treatment of the data difficult. Potassium ferricyanide appears to be less toxic than potassium cyanide or sodium cyanide to *Periplaneta*, possibly because of considerable stability of the ferricyanide radical.

BEACHER (J. N.). **Studies of Pistol Case-bearer Parasites.**—*Ann. ent. Soc. Amer.* **40** no. 3 pp. 530–544, 11 refs. Columbus, Ohio, 1947.

Serious outbreaks of *Coleophora malivorella*, Ril., have occasionally occurred on apple in several sections of the eastern and central United States and in Canada. Parasites have been regarded as a dominant factor in reducing the importance of this case-bearer as an apple pest, and investigations on their value were carried out, mainly in Pennsylvania, during 1940 and 1941, in conjunction with studies of its life-history [*R.A.E.*, A **30** 287].

No parasites were reared from 1,500 eggs collected from various orchards near Arendtsville, Pennsylvania, on 16th July 1940, several days after the peak of egg deposition, though three have been recorded from West Virginia or Virginia [*cf.* **29** 363], nor from 2,000 first- and second-instar larvae collected in the same area on 30th July and 25th August. Overwintered (third-instar) larvae collected in Pennsylvania, Virginia and Illinois during the first week of April 1940 showed 4·5, 9·7 and 1·9 per cent. parasitism, respectively, and some collected in Delaware in April 1941 showed 22·2 per cent. The overwintering larvae were generally attacked throughout September and October, when most were fixed in hibernating positions on the twigs. Some were parasitised while still feeding on the foliage and remained attached to it, owing to paralysis induced by the parasite stings, so that they dropped to the ground at leaf-fall. The parasites recovered from the various collections comprised *Eurydinota lividicorpus*, Gir., *Habrocytus phycidis*, Ashm., and *Eupelmus cyaniceps* var. *amicus*, Gir., which represented 94·1, 4·2 and 1·7 per cent. of the population, respectively. They overwintered as pupae within the host cases, and emergence began towards the end of April and reached a peak during the first half of May. Parasites from cases collected during 15th–20th June in eight orchards near Arendtsville emerged between 18th June and 29th July, with two peaks of emergence, on 25th June and 15th–17th July. The percentage parasitism was 6–24, with an average of 9·3. The 15 species reared and (in brackets) the percentages of the total represented by the most numerous ones were *Eurydinota lividicorpus* (59·9), *Habrocytus phycidis* (8·9), *Bracon* (*Microbracon*) *pygmaeus*, Prov. (7·4), *Ephialtes hispae*, Harr. (*Epiurus indagator*, Cress.) (5·3), *Anachaetopsis tortricis*, Coq. (4·4), *Eupelmus cyaniceps* var. *amicus* (4·2), *Hemiteles tenellus*, Say (3·9), *Acrolyta aletiae*, Ashm., *Aphelinus mali*, Hald., *B.* (*M.*) *gelechiae*, Ashm., *Dibrachys cavus*, Wlk., *Eurytoma tylodermatis*, Ashm., *Spilochalcis albifrons*, Walsh, *Sympiesis* sp. and *Tetrastichus* sp. All attacked the mature larvae, with the exception of *Anachaetopsis*, which was reared from the pupae. The emergence of *Eurydinota* occurred uniformly throughout the period in which the case-bearers were under observation, but *B. pygmaeus* emerged in large numbers during 18th–30th June, *Habrocytus* between 1st and 12th July and *Eupelmus* between 13th and 29th July. *D. cavus* and *Hemiteles tenellus* were both primary parasites and secondary parasites of *Eurydinota* and *Habrocytus*, and it is probable that these species and others may be important in reducing populations of primary parasites and so permitting outbreaks of the case-bearer. The one female of *Aphelinus mali* was an accidental parasite. Parasites from host cases collected during June 1941 in two apple orchards at Camden, Delaware, emerged between 3rd June and 11th July with a peak between 14th and 20th June. The average parasitism was 26·8 per cent. Of the five species reared, *Eurydinota lividicorpus* comprised 80·3 per cent. and *Habrocytus phycidis*, *Ephialtes hispae*, *Hemiteles tenellus* and *Eupelmus* 12, 4·6, 2·6 and 0·5 per cent.

Parornix prunivorella, Chamb., which was numerous on the foliage of every apple orchard from which case-bearer collections were made, was found to be an alternate host of the species of *Sympiesis* and *Tetrastichus*, but none was found for *Eurydinota*, the adults of which emerged in June and July, but did not attack the larvae until September, and it is possible that the lack of alternate hosts is a limiting factor in the size of the parasite population. Overwintered larvae collected in April 1941 from orchards in Delaware that were unsprayed or sprayed with lead arsenate for the control of the codling moth [*Cydia pomonella*, L.] showed 26·5 and 14·8 per cent. parasitism, respectively, and samples collected in June showed 32·2 and 9·5 per cent. A list of parasites of *Coleophora malivorella* recorded by various workers in Pennsylvania, Delaware, Illinois, Virginia and West Virginia is included.

Observations were made in the laboratory on the bionomics of *E. lividicorpus*, which is an ectoparasite. The egg, larval and pupal stages averaged about 2, 11 and 7 days, and the life-cycle lasted 18–22 days, depending on the duration of the pupal stage. The females lived for an average of 25·5 days when given raisins as food, with a maximum of 65 days, and deposited an average of 21 eggs, the number of larvae observed on one host in the field ranged up to 17, and in one instance in the laboratory, ten adult parasites matured on one host. There appeared to be at least two generations in the year.

GARLICK (W. G.). **A five-year Field Study of Codling Moth Larval Habits and Adult Emergence.**—*Sci. Agric.* **28** no. 7 pp. 273–292, 7 graphs, 5 refs. Ottawa, Ont., 1948.

In each year from 1941 to 1945, larvae of the codling moth [*Cydia pomonella*, L.], were collected from burlap bands round the trunks of trees of two varieties in a heavily infested apple orchard in Ontario and their subsequent development was observed in an open-air insectary. The trees were selected for their freedom from crevices and the trunks were scraped. The bands were fixed on in the last week of June, and the larvae were collected from them every other day, placed in jars with rolls of corrugated paper, and kept protected from direct sunlight. A preliminary test of the reliability of bands in population studies, in which 32 bands were placed on a tree in addition to the one on the trunk, showed that 45 per cent. of the total number of larvae taken in them were at the top of the tree, 17 per cent. on the main limbs, and 38 per cent. on the trunk, which agreed fairly closely with the results obtained by direct counts on trees in 1935. Evidence was obtained that larvae on a well-scraped tree wander over most of it in seeking quarters in which to spin their cocoons ; one band should therefore eventually trap all except those that find suitable sites near the top, which may comprise 30 per cent. of the total, excluding those destroyed by predators. Larvae that leave the tree permanently by crawling off it or in dropped fruit tend to be replaced by larvae from other trees ; in 1941, 252 larvae were found in a band on a tree that bore no fruit. The proportion collected in bands is affected by the amount of débris on the ground ; as many as 160 larvae were found in a small wooden container for mouse bait left in the orchard. Mortality due to predators was not investigated but was probably less than that recorded by Jaynes & Marucci [*R.A.E.*, A **36** 220]. In a discussion of the value of bands for control, it is pointed out that, in order to trap a minimum of 70 per cent. of the larvae, the trees must be very carefully scraped and the ground cleared of débris, and the cost of this under local conditions is considered prohibitive. Tests with bands treated with β-naphthol in oil indicated that this material is repellent until much of it has been removed by weathering.

An average of about 590 larvae was collected per tree per year, and little varietal difference was noted in the numerical relationship of larvae to fruit. No conclusive results were obtained regarding the relation of numbers of

mature larvae to numbers of infested fruits. Over the whole period, the earliest date on which larvae were collected was 28th June and the latest in November, though few were collected after the middle of October ; except on one occasion in 1945, they were found at each examination until about the middle of October. First- and second-generation larvae could not be distinguished in the field. Larvae parasitised by *Ascogaster quadridentata*, Wesm., travelled considerable distances to trunk bands, despite their small size. Some evidence was obtained that figures for parasitism based on collections from trunk bands may be too low, since the percentage parasitism was 19·9 in larvae from a tree with many bands, and averaged 13·7 in larvae from trunk bands on trees of the same variety in the same year. Parasitised larvae were present almost throughout the season. During 1941–43, the annual percentage parasitism varied from 13·7 to 17·8 on one variety (McIntosh) and from 20·6 to 28·8 on the other (Ontario) ; in 1944, when adults of *Ascogaster* were released in large numbers nearby, it was as high as 37·4 and 38·6, respectively, but fell to 23·6 and 14·3 in 1945. The most important factors limiting the parasite appear to be species of *Perilampus* [*cf.* **30** 111], but copper fungicides applied in 1941–43 and wettable-sulphur sprays applied in 1944 and 1945 may also have had some effect.

In determining the percentage of first-generation individuals that completed their development in a single season, all larvae in the collections from which moths emerged were regarded as belonging to the first generation. The percentage that transformed in the same season averaged about 50 in 1941–44 but only 26·8 in 1945. It was a little higher on Ontario than on McIntosh, which matures about a month earlier. Nearly all the earliest larvae transformed, but each year, regardless of weather conditions, only diapause larvae were produced after 24th August, though those reared in the insectary in picked fruits showed more variation. The percentages of larvae maturing by given dates that transformed differed little from year to year ; they decreased from about 80 and 70 in larvae that matured on 31st July and 3rd August to 5 and 0 in those that matured on 15th and 27th August. If large numbers mature before 25th July, the second generation is likely to be large, and if the orchard contains late as well as early varieties of apple, the overwintering population will also be large. It was estimated from previous experiments that apple fruits of the two varieties used have practically completed their growth by about 6th July. Larvae entering them then would mature about 20th–25th July. The subsequent increase in the tendency to diapause may be related to a change in the nature of the food provided by the ripening fruit [but *cf.* **31** 259], and if it is, the larvae probably require a minimum amount of the changed food to be affected, or to have it at a definite developmental stage, or both.

The duration of the prepupal stage was not investigated, but no pupae were found in bands examined every two days. Emergence of first-generation moths usually began in the second half of July and was completed some time in September, so that spray protection is necessary during most of August if the first generation has not been well controlled.

Winter mortality among the larvae from both varieties varied from 15 to 36 per cent. in the insectary. Emergence of the overwintered generation began 6–21 days earlier in the orchard than in shade in the insectary, but the relation was generally fairly close. Emergence continued over an average of 51 days in 1941–46 ; there was a general tendency for the earliest moths to be derived from the larvae that matured first, and for those that matured within the next three or four weeks to give rise to moths progressively later. Those from still later groups emerged either at the same time as or earlier than the latter, and the last group to mature generally gave rise to moths only slightly later than the first.

A total of 83 larvae collected during 1944–46 overwintered twice ; 35 per cent. of them were collected before 30th August, 30 per cent. between 1st and 15th September, 25 per cent. between 15th and 30th September, and 10 per cent. between 1st and 13th October. Some indication was obtained that moths from such individuals emerge earlier in the year than those from normal larvae. Attempts to determine the factors causing the production of long-diapause larvae gave inconclusive results. Larvae that had overwintered out of doors in corrugated cardboard, been kept at about 40°F. from spring till autumn and again overwintered out of doors gave rise to moths with little mortality in the spring. Of 244 overwintering larvae kept under crowded conditions at reduced temperatures and high humidities in the orchard, 3 per cent. overwintered a second time, whereas none of 109 kept under less stringent conditions did so.

REINIGER (C. H.). **Queda prematura das fôlhas e capulhos do algodoeiro.** [A premature Dropping of the Leaves and Bolls of Cotton.]—*Bol. fitossanit.* **2** no. 2 pp. 129–132, 4 figs., 4 refs. Rio de Janeiro, 1947.

Severe dropping of the leaves and bolls of cotton at Ipu, in the State of Ceará, was found to be due to *Hercothrips fasciatus*, Perg., which had not previously been recorded from Brazil. Its eggs are deposited in the petioles and leaves, and the nymphs and adults feed on both surfaces of the latter. Good control was given by sprays of 0·15 per cent. nicotine sulphate and 0·15 per cent. soap or of 3·5 lb. timbo powder (6 per cent. rotenone) and 2 lb. soap per 100 gals. water.

GONÇALVES (C. R.). **Notas práticas sôbre a conservação do milho.** [Practical Notes on Maize Storage.]—*Bol. fitossanit.* **2** no. 2 pp. 133–143, 6 figs., 15 refs. Rio de Janeiro, 1947.

Calandra (*Sitophilus*) *oryzae*, L., the bionomics of which are summarised from a paper by R. T. Cotton [*R.A.E.*, A **9** 182], causes great damage to stored maize in parts of Brazil. Infestation occasionally originates in the field, where the weevil breeds in fallen grain or damaged ears, but most of the injury occurs in store. The control measures recommended are field sanitation, the rejection of damaged ears, cleanliness in storage premises and fumigation with carbon bisulphide. Directions for fumigating and for constructing an airtight building that will serve as a fumigation chamber and a storehouse are given.

LEPAGE (H. S.), GIANNOTTI (O.) & ORLANDO (A.). **Combate ao mandarová da mandioca** (*Erinnyis ello* (**L.**)). [The Control of *E. ello* on Cassava.]—*Biológico* **13** no. 4 pp. 76–80, 1 col. pl. São Paulo, 1947.

Erinnyis ello, L., is a serious pest of cassava [*Manihot utilissima*] in the State of São Paulo, Brazil, where that crop is being increasingly grown. The eggs, which are laid on the leaves at night from November to March, hatch in less than a week, and the larvae feed on the leaves, defoliating the plants in a few days, and pupate in the soil or among crop remains. The larval and pupal stages last about a fortnight each.

Following a laboratory finding that dinitro-o-cyclohexylphenol was about ten times as toxic to the larvae as lead arsenate and five times as toxic as paris green, the most effective insecticide against them hitherto known, field tests with sprays were carried out in two localities [*cf. R.A.E.*, A **35** 108]. In the first, the mortality percentages were 35 and 30 for Gesarol A and Gesarol M (5 and 10 per cent. DDT) at 1 per cent., neither of which was effective against larvae that had passed beyond the third instar, 20 for 0·1 per cent. paris green with 0·5 per cent. lime, and 85 for 0·5 per cent. I.B.943 (10 per cent. of the

dinitro compound in talc) with 0·3 per cent. starch, all in 24 hours, in one test, and 30 for 0·5 per cent. barium fluosilicate, 35 for 0·75 per cent. cryocide [cryolite], 25 for 0·75 per cent. phenothiazine, and 65·5 for 0·5 per cent. I.B.943, all with 0·3 per cent. starch, in 30 hours in another. There was no mortality in the controls. In the other locality, the mortality percentages after 24 and (in brackets) 48 hours were 40·2 (88·8) for 0·5 per cent. I.B.943 with 0·3 per cent. starch, 14·4 (55) and 24·6 (64·3) for 0·15 and 0·3 per cent. of a benzene-hexachloride powder (Agrocide 3) containing 3 per cent. γ isomer, and 15 (50) for 0·1 per cent. paris green with 0·5 per cent. lime ; 0·4 per cent. paris green with 1 per cent. lime killed 59·4 per cent. in 48 hours. Mortality in the controls was high (19·3 and 33·8 per cent. in 24 and 48 hours) owing to the occurrence among the larvae of a disease probably due to a fungus.

Carrera (M.) & Travassos filho (L.). **Dados morfológicos e bionômicos sôbre *Hylemyia poeciloptera* (Malloch, 1921) (Diptera : Anthomyidae), minadora das folhas de beterraba (*Beta vulgaris* L.).** [Data on the Morphology and Bionomics of *H. poeciloptera* mining the Leaves of Beet.]—*Papéis avulsos Dep. Zool.* **8** no. 4 pp. 49–62, 12 figs., 7 refs. São Paulo, 1947. (With a Summary in English.)

Larvae found mining the leaves of beet in a small planting in São Paulo, Brazil, in September 1943 gave rise to adults that were identified as *Hylemyia poeciloptera*, Mall. Infested leaves contained up to five larvae each, and a few of the plants were killed by the infestation. The larvae left the plants when full-fed and pupated in the soil, the adults emerging after 18–20 days. The infestation did not recur in 1944 or 1945, and no adults were observed in the field, though adults of *H. punctipennis*, Wied., were common. Attempts to rear larvae of the latter on beet proved unsuccessful. The adults, larva and puparium of *H. poeciloptera* are described.

Otamendi (J. C.). **Procedimiento de combate contra las hormigas podadoras, mediante el empleo del sulfuro de carbono gasificado en frío.** [A Method of controlling Leaf-cutting Ants by Means of Carbon Bisulphide vaporised cold.]—[*Publ.*] *Inst. Sanid. veg.* (B) **3** no. 9, 7 pp., 1 fig. Buenos Aires, 1947.

Carbon bisulphide has proved the most satisfactory fumigant for the control of leaf-cutting ants of the genera *Atta* and *Acromyrmex* in Argentina, but methods of applying it have been defective. A description is therefore given of a Brazilian apparatus that pumps a mixture of air and vapour into the nest through a tube inserted into the largest hole, all the other openings being stopped up [*R.A.E.*, A **31** 479]. About 250 cc. liquid is used per nest, and if activity persists after a fortnight, the treatment is repeated. In practical tests, 95 per cent. of all the colonies treated were completely destroyed, including those of *Acromyrmex lundi*, Guér., the most difficult of these ants to control.

De Santis (L.). **Dos nuevos Calcidoideos interesantes (Hymenoptera, Chalcidoidea).** [Two interesting new Chalcidoids.]—*Rev. Soc. ent. argent.* **13** no. 1–5 pp. 281–291, 3 figs. Buenos Aires, 1947.

The two new species described are the Encyrtid, *Pseudaphycus griseus*, from adults of both sexes reared from an unidentified species of *Pseudococcus* found on pear in La Plata, Argentina, and the Aphelinid, *Coccophagus*

semiatratus, from a single female reared from *Coccus hesperidum*, L., in Asunción, Paraguay.

Costa (J. J.), Santa Maria (H. C.) & Lamdan (S.). **Contribución al estudio del hexaclorociclohexane o 666. Su química y su poder insecticida.** [A Contribution to the Study of Benzene Hexachloride or 666. Its Chemistry and Toxicity to Insects.]—[*Publ.*] *Inst. Sanid. veg.* (A) **3** no. 26, 35 pp., 7 figs., 23 refs. Buenos Aires, 1947. (With a Summary in English.)

The authors review from the literature the discovery, preparation, physical and chemical properties, value and mode of action as an insecticide and toxicity to warm-blooded animals of BHC (benzene hexachloride), describe methods of quantitative analysis and of isolating the γ isomer and give a short account of tests carried out with the compound in Argentina. When adult locusts [*Schistocerca paranensis*, Burm.] in cages were dusted with crude BHC in infusorial earth, freed from excess dust and transferred to clean cages containing food, 10 per cent. BHC killed all of ten, 5 per cent. killed four of five and affected the other one, and 2·5 per cent. killed two of five, all in 24 hours. When the pure γ isomer was used at the same concentrations, all the locusts were dead in 3·5, 24 and 24 hours, respectively. Fifth-instar hoppers treated *per os* with a mixture of the α, β and δ isomers showed symptoms of poisoning in 20 hours. In field tests, dusts containing 3·7 and 7·5 per cent. BHC killed young hoppers in 20–40 minutes, and 15 per cent. BHC killed them in 15 minutes ; a concentration of 4–5 per cent. would probably be sufficent in practice. Baits containing 0·3 per cent. BHC destroyed bands of fourth- and fifth-instar hoppers in 18 hours.

BHC also proved very effective in laboratory tests both as a contact poison and as a fumigant against *Calandra granaria*, L. In comparative tests against the green cereal Aphid, *Toxoptera* (*Schizaphis*) *graminum*, Rond., in which, however, no account was taken of parasitism by *Aphidius platensis*, Brèth., the apparent mortality percentages averaged 0, 88·5 and 99·5 in 1, 12 and 24 hours, respectively, for 5 per cent. BHC in talc, 0 and 100 in 1 and 24 hours for 5 per cent. DDT, 84·5 in 15 minutes, with no increase in 12 hours, for 1·25 per cent. nicotine sulphate, 90·5 in 15 minutes, with no increase in 12 hours, for 20 per cent. Lethane (containing aliphatic thiocyanates) and 1 in 24 hours in the control.

When food containing 0·3 or 1·5 per cent. BHC was offered to horses, cattle, sheep and pigs, the animals were repelled by the odour. They accepted the food after being starved for three days, and the ingestion of 3–5 kg. food containing 0·3 per cent. BHC for 5–6 days then had no harmful effects, but animals, particularly horses and sheep, that ingested 15–20 kg. food containing 1·5 per cent. died after 5–6 days. The minimum toxic dose for these animals is considered to be 1 gm. BHC per kg. live weight.

Mathlein (R.). **Ett skadedjur i importerade fodermedel.** [A Pest in imported Feedingstuffs.]—*Växtskyddsnotiser* 1948 no. 2 p. 29, 1 fig. Stockholm, 1948.

Wheat bran imported into Sweden in 1947 was in many cases more or less heavily infested by insects, of which the cosmopolitan *Tribolium castaneum*, Hbst., was the most numerous and injurious. It has occasionally occurred in Sweden before, but has not caused any great damage. In tests, the minimum temperature for oviposition and larval development was between 17 and 19°C. [62·6 and 66·2°F.], and eggs, larvae and adults died within a month in material stored at 2–3°C. [35·6–37·4°F.]. Infestation is not therefore likely to persist through the winter in materials stored in unheated premises in Sweden.

ROBERTI (D.). **Le oplocampe del susino. I.** *Hoplocampa flava* **(L.).** [*Hoplocampa* spp. on Plum. I. *H. flava.*]—*Boll. Lab. Ent. agr. Portici* **7** pp. 41–92, 28 figs., 21 refs. Naples, 1947.

All stages of *Hoplocampa flava*, L., are described, and an account is given of observations on its bionomics and control on plum to the south of Naples, where it is the predominant species of its genus on that crop and causes 50–100 per cent. loss in some years. Many varieties of plums and *Prunus insititia* are attacked, as also were apricots growing near heavily infested plums in 1946, but *P. avium* is not, and the various varieties of cherry plum (*P. cerasifera*) flower too early to be infested.

The adults emerged in March, when the preferred varieties of plum were beginning to flower, and paired after a day or two, and the females deposited their eggs in the tissue of the buds or the calyces of the flowers. In 1946 and 1947, females were twice as common as males and laid 50–70 eggs each. The larvae hatched in 9–14 days, entered the young fruits and fed for about 25 days, attacking the kernels during the last 4–5 days. They moved from one fruit to another, each larva thus destroying 2–4 fruits, and the damaged fruits dropped. When full-fed, the larvae left the fruits and constructed cocoons in the soil, in which they overwintered, pupating in February of the following year. The adults emerged a fortnight later.

Some 30–40 per cent. of cocoons examined in April 1947 contained dead larvae, thought to have been killed by a bacterial disease, but the chief agent of natural control is *Angitia macrostoma*, Thoms., all stages of which are described and which parasitised 31 per cent. of larvae in 1946 and 40 per cent. in 1947. Females of this Ichneumonid emerged at the same time as the adults of the sawfly ; males are unknown. Its eggs were deposited in the growing sawfly larvae, and only one parasite matured per host. Development continued slowly during winter, but the vital organs of the host were not destroyed until early February, after which the parasite left the remains and pupated in a cocoon within that of the host.

Some control of *H. flava* is afforded by jarring the adults from the trees in the early morning, destroying infested fruitlets, and spraying against the larvae with lead arsenate, nicotine sulphate, quassia or DDT. In a small test in 1946, a proprietary DDT spray proved fairly effective and more so than lead arsenate or nicotine sulphate, which was little better than no treatment. Two applications, the first when three-quarters of the petals had fallen, and the second ten days later, were more effective than the first only.

JANNONE (G.). **Studi e ricerche di entomologia agraria in Eritrea e in Etiopia. II. Ovodeposizione, sviluppo e costumi delle prime larve di** *Stomatorrhina* (*Idia*) *lunata* **Fab. (Dip., Muscidae), oofago della** *Schistocerca gregaria* **(Forsk.).** [Studies and Researches on agricultural Entomology in Eritrea and Abyssinia. II. Oviposition, Development and early larval Habits of *S. lunata* attacking the Eggs of *S. gregaria.*]—*Boll. Lab. Ent. agr. Portici* **7** pp. 316–325, 2 figs. Naples, 1947.

Larvae of *Stomatorrhina lunata*, F., have frequently been recorded feeding on the eggs of *Schistocerca gregaria*, Forsk., and other locusts, but the oviposition habits of this Calliphorid were not well known. On 26th July 1946, while observing the movements of a swarm of *S. gregaria* in Eritrea, the author noted numerous females of the fly approaching ovipositing locusts. As soon as the locusts left the holes in which they had laid their eggs, the flies backed into the holes and oviposited into the top of the oötheca through the adhesive material with which the eggs were covered, which was still soft. Egg-pods examined each contained 12–20 eggs of the fly. The larvae hatched in less than two days, crawled down to the locust eggs and began to suck them.

Chamberlain (E. E.). **Virus Diseases of Tree Tomato** (*Cyphomandra betacea* **Sendt.). 1. Cucumber Mosaic** (*Cucumis virus* **1 of Smith, 1937**).—*N. Z. J. Sci. Tech.* **29** (A) no. 5 pp. 256–260, 2 figs., 3 refs. Wellington, N. Z., 1948.

The cultivation of tree tomato (*Cyphomandra betacea*) has increased considerably in New Zealand in recent years, and it has been attacked by several diseases, including some due to viruses. One of these viruses, which is widely distributed in tree tomato, is shown by comparative experiments on its host range and symptoms in mechanically inoculated plants and its physical properties, and by the way in which it was transmitted by *Myzus persicae*, Sulz., to be identical with the virus of cucumber mosaic, which occurs in other plants throughout New Zealand. The symptoms in tree tomato comprise mottling and narrowing of the leaves, reduction in the amount of foliage and fruits, and the appearance of dark blemishes on the ripe fruit. The virus was transmitted experimentally by *M. persicae* when the Aphids were starved for two hours, allowed to feed on infected tree tomato for only 4–6 minutes, and then kept in batches of 12 on healthy plants for 22 hours, but not when they were transferred directly from healthy swede plants to infected tree tomato and left on these for 18 hours before being transferred to healthy plants. The virus was not carried in the seed of tree tomato.

Taylor (G. G.). **Experiments for Control of White-butterfly** (*Pieris rapae* **L.) and Diamond-back Moth** (*Plutella maculipennis* **Curt.) on Cabbages.**—*N. Z. J. Sci. Tech.* **29** (A) no. 5 pp. 265–272, 5 refs. Wellington, N. Z., 1948.

An account is given of experiments in New Zealand in the three seasons 1944–47 in which DDT was compared with other insecticides for the control of *Pieris rapae*, L., and *Plutella maculipennis*, Curt., on cabbage. The results obtained in 1944–45 have been noticed from a preliminary report [*R.A.E.*, A **35** 64]. In 1945–46, when six applications were made in February–April, the percentages of cabbages free from damage were 3·4 and 1·8 for derris dusts containing 0·25 per cent. rotenone with pyrophyllite and a mixture of magnesite-talc and clay (1 : 1), respectively, as the diluent, 17·7 and 45·3 for a benzene-hexachloride dust diluted to contain 0·18 and 0·36 per cent. γ isomer, 58·3 and 73·3 for 0·75 and 1·5 per cent. DDT in the mixture of magnesite-talc and clay, and 78 and 55·6 for 0·75 per cent. DDT micronised in this diluent so that 95 per cent. of the particles were less than 20 and 7 μ, respectively. Sprays containing 0·075 per cent. DDT prepared from a wettable powder, a proprietary emulsion concentrate and emulsified xylene solution gave 83·5, 79·9 gnd 86·1 per cent. undamaged cabbages. In 1946–47, DDT in micronised dusts and sprays of a wettable powder, in all of which 95 per cent. of the particles had a size of less than 20 μ were tested in different schedules of application during February and March. The percentages of undamaged cabbages for the dusts were 97·9 and 85·5 for 0·5 per cent. DDT applied 8 times at intervals of 6 days and 4 times at intervals of 12 days, respectively, 90·8 and 68·3 for 1 per cent. DDT applied 4 times at intervals of 12 days and 3 times at intervals of 18 days, and 85·3 for 2 per cent. DDT applied 3 times at intervals of 18 days. For the sprays, they were 75·2 and 28·1 for 0·025 per cent. DDT applied 8 times at intervals of 16 days and 4 times at intervals of 12 days, 68·1 and 41·4 for 0·05 per cent. DDT applied 4 times at intervals of 12 days or 3 times at intervals of 18 days, and 65·8 for 0·1 per cent. DDT, also applied 3 times at intervals of 18 days. In each year, untreated cabbages adjacent to the experimental plots became so heavily infested, first by *Pieris* and later by *Plutella*, that they were not marketable.

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Agricultural Chemicals (New York, N.Y.) : Vol. 1 (1946) Nos. 1–5.
Agricultural Journal, Department of Agriculture, British Columbia (Victoria) : Vol. 1 (1916), Nos. 1 and 2.
Agricultural News (Barbados) : Nos. 1, 25, 26, 34, 66 (1902–04).
Agriculture and Animal Husbandry in India (Delhi): 1937–38.
American Journal of Veterinary Research (Chicago, Ill.) : Vols. 1 & 2 (1940–41) Nos. 1–5.
Analele Institutului de cercetări Agronomice al României (Bucharest) : Tome 14 (1942).
Annals of the Queensland Museum (Brisbane) : No. 5.
Arbeiten der Biologischen Station zu Kossino (Moscow) : Lief. 1 (?1925).
Archives de l'Institut d'Hessarek (Hessarek–Karadj) : Fasc. 1 (1939), 2 (1940).
Archives de l'Institut Pasteur de Tunis : 1906 fasc. 4 ; 1907 fasc. 1 & 3 ; 1908 ; 1909 fasc. 1–2, 4 ; 1910 fasc. 1–3 ; 1911 fasc. 3–4.
Archives du Musée Zoologique de L'Université de Moscou : Vol. 5 (?1938).
Arizona Commission of Agriculture and Horticulture (Phoenix, Ariz.) : 1st–10th Annual Reports ; Circulars 15–16 (1909–18).
Arquivos do Instituto Bacteriologico Câmara Pestana (Lisbon) : Vol. 1 (1906).
Bee World (Benson, Oxon) : Vols. 1–2 (1919–21).
Bericht über die Wissenschaftlichen Leistungen im Gebiete der Entomologie während des Jahres 1914 (Berlin) : Nos. 1 & 5.
Biological Bulletin of the Marine Biological Laboratory (Woods Hole, Mass.): Vols. 1–2 (1899–1901) ; 23 (1912) ; 24 (1912) No. 2 ; 25 (1913) Nos. 5–6 ; 26 (1914) Nos. 1–2 ; 27 (1914) No. 4 ; 28 (1915) No. 1 ; 29 (1915) No. 5 ; 30 (1916) Nos. 2–3 ; 31 (1916) Nos. 4 & 6 ; 32–33 (1917) ; 34 (1918) Nos. 1–4 ; 35 (1918) ; 36 (1919) Nos. 2–3 ; 37 (1919) Nos. 4 & 6 ; 38 (1920) Nos. 1, 2, 5 & 6 ; 39 (1920) Nos. 4–6 ; 40 (1921) Nos. 1–3 & 6 ; 41 (1921) Nos. 2 & 3 ; 42 (1922) Nos. 1–3.
Boletín de la Dirección de Estudios Biológicos (Mexico) : Tomos 1–2 (1924–25).
Bollettino della Società Italiana di Biologia Sperimentale (Naples) : Vols. 17 (1942) Nos. 5–6 ; 18–21 (1943–45).
Bulletin Agricole de l'Algérie-Tunisie-Maroc (Algiers) : Année 20 (1914) Nos. 7–9, 12–14.
Bulletin du Comité d'Études Historiques et Scientifiques de l'Afrique Occidentale Française (Paris) : Année 1919 No. 1.
Bulletin de l'Institut des Recherches Biologiques (Perm) : Tome 1 (1923) fasc. 1–2.
Bulletin de la Station Régionale Protectrice des Plantes à Leningrad : Vol. 6 (?1927) ; 7 (1936) No. 2.
Bulletin of the Stoneham Museum (Kitale) : Nos. 37, 41.
Caribbean Forester (New Orleans, La.) : Vol. 1 (1940) No. 1.
Chacaras e Quintaes (São Paulo) : Indices to Vols. 10, 11, 12, 14 ; Vol. 42 (1930) No. 3.
Chinese Medical Journal (Chengtu) : Vol. 61A (1942) No. 1.
Choroby Roślin (Warsaw) : T.1 cz.1 (1931).
Comptes Rendus des Séances de l'Académie d'Agriculture de France (Paris) : Tome 8 (1922) No. 5.
Comptes Rendus de l'Académie des Sciences de l'URSS (Moscow): (N.S.) Vols. 26 (1940) Nos. 8–9 ; 27 (1940) ; 28 (1940) No. 1 ; 33 (1941) Nos. 4–6 ; 41 (1943) Nos. 8–9 ; 44 (1944) Nos. 4–9 ; 45 (1944) No. 1 ; 48 (1945) Nos. 4–5, 8–9 ; 54 (1946) No. 9 ; 55 (1947) No. 7 ; 56 (1947) No. 2.
Cyprus Agricultural Journal (Nicosia) : Vol. 23 (1928) Pt. 3.
Dokladui Akademiĭ Nauk SSSR (Moscow) : (N.S.) Vols. 57–58 (1947) ; 59 (1948) Nos. 8–9 ; 60 (1948) Nos. 1–3.
Egatea, Revista da Escola de Engenharia de Porto Alegre, Brazil (Porto Alegre) : Vols. 1–6 (1916–21) ; 7 (1922) Nos. 1–5 ; 8 (1923) Nos. 2–5 ; 9 (1924) Nos. 1, 4–6.
Egypt. Ministry of Agriculture (Cairo) : Bulletins 158, 162, 170–172, 174, 204, 212, 215, 227, 228, 230, 232, 235 ; Report of the Entomological Section for 1923–24.
Entomologische Litteraturblätter (Berlin) : 6 Jahrg. (1906) Nos. 2 & 10.
Experiment Station Record (Washington, D.C.) : Vols. 1–4 (1889–94).
Fitófilo (San Jacinto, D. F.) : Año 1 (1942) No. 6.

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Florida Agricultural Experiment Station (Lake City & Gainesville, Fla.): Reports for 1896, 1898–99, 1899–1900, 1900–1901, 1908–09.
Folia Myrmecologica et Termitologica (Bernau b. Berlin): Vol. 1 (1927) No. 10 to end.
Forest Products Research Board (London): Report for the period ended 30th September, 1928.
Forêt Québecoise (Quebec): Vols. 1 (1939) Nos. 1, 4, 6, 10; 2 (1940) Nos. 1, 3, 6.
Gambia: Medical and Sanitary Reports 1939–42.
Georgia State Board of Entomology (Atlanta, Ga.): Bulletins 2, 6, 22 and 28; Circulars 1–3, 12, 15–18 and 20.
Gold Coast Department of Agriculture: Bulletin 25 (1932).
Harvard Forest Bulletin (Petersham, Mass.): No. 5 (1922).
Hong Kong. Botanical and Forestry Department: Reports for 1928 & 1939.
India. Forest Research Institute (Dehra Dun): Forest Bulletin (Old Series) Nos. 1–3.
India. Imperial Council of Agricultural Research (Delhi): Annual Report for 1939–40.
Indian Central Jute Committee. Agricultural Research Laboratory (Calcutta): Annual Report 1941–42.
Indian Lac Research Institute (Namkum): Report for 1942–43.
Indian Medical Gazette (Calcutta): Vols. 50 (1915) No. 10; 51 (1916) Nos. 1–7, 10; 52 (1917) No. 7 and title-page & index; 53 (1918); 54 (1919) No. 2; 76 (1941) title-page & index; 77 (1942) No. 8; 78 (1943) Nos. 1 & 10; 81 (1946) title-page & index.
Insekto Interesa (Nantung): Vols. 1 (1935) Nos. 1, 4 to end; 2 (1936) No. 5 to end.
Izvestiya Uzbekistanskogo Filiala Akademiĭ Nauk SSSR (Tashkent): 1940 No. 9.
Jamaica. Department of Agriculture (Kingston): Bulletin 31 (1941); Annual Report 1903–04, 1907–08, 1909–10, 1911–12.
Journal of Agricultural Research (Washington, D.C.): Vols. 59 (1939) Nos. 4, 5, 11, 12; 61 (1941) No. 3.
Journal of the Board of Agriculture of British Guiana (Demerara): Vol. 3 (1909) No. 1; title-pages & indices to vols. 1–2.
Journal of the South-Eastern Agricultural College (Wye, Kent): Nos. 1–6, 8 (1895–99).
Kenya and East African Medical Journal (Nairobi): Vol. 2 (1925) Nos. 2–3.
Konowia (Vienna): Bd. 17 (1939) Heft 2–3.
Medical Parasitology and Parasitic Diseases (Moscow): Vols. 1 (1932) No. 1; 11 (1943) Nos. 1–3; 12–13 (1943–44); 14 (1945) Nos. 5–6; 15 (1946) Nos. 1–3.
Mezögazdasági Kutatások (Budapest): Vols. 2 (1929) No. 7–8; 13 (1940) Nos. 7, 11–12; 14 (1941) Nos. 4, 8–12 & index.
Mitteilungen der Gesellschaft für Vorratsschutz (Berlin): Jahrg. 16 (1940) Hefte 1 & 5; 17 (1941).
Natuurhistorisch Maandblad (Maastricht): Jaarg. 1 (1912); 2 (1913) Nos. 1–4, 6–9; 5 (1916) Nos. 3–4; 7 (1918) Nos. 6–9; 8 (1919) No. 4.
Nauchnuie Zapiski po Sakharnoĭ Promuishlennosti. Agronomicheskiĭ Vuipusk (Kiev): God 14 (1937) vuip. 4–6; 15 (1938) vuip 5–6.
New Jersey State Department of Agriculture (Trenton, N. J.): Circulars 2, 12, 29 (1917–19).
New York State Museum (Albany, N.Y.): Bulletin 57 (1902).
North Carolina Agricultural Experiment Station (Raleigh): 38th (1914–15), 49th (1925–26), 51st (1927–28), 52nd (1928–29) Reports.
Northern Rhodesia. Veterinary Department: Report for 1940.
Ontario Entomological Society (Toronto): 9th Report (1878).
Ormerod (E. A.). Observations of Injurious Insects and Common Farm Pests during the Years 1877 & 1878 (London, 1878–79).
Pensée Médicale d'Usbéquistane et de Turquménistane (Tashkent): Vol. 5 (ix-x) (1931) Nos. 1–3, 5 to end.
Peru. Ministerio de Agricultura. Estación Experimental Agrícola de La Molina (Lima): Informe 56 (1943); Boletín 24 (1943); Circular 61 (1943).
Pests and Their Control (Kansas City, Mo.): Vol. 15 (1947) Nos. 7–8.
Philippine Agriculturist (Laguna): Vol. 30 (1941) No. 9.
Philippine Journal of Agriculture (Manila): Vols. 9 (1938) No. 3; 10 (1939) No. 3; 11 (1940) Nos. 1–3 & index; 12 (1941) No. 3 & index.
Philippine Journal of Science (Manila): Vols. 72 (1940) No. 4; 76 (? 1941) No. 2.
Porto Rico Department of Agriculture, &c. (San Juan): Journal, Vol. 1 (1917) No. 3.
Proceedings. California Mosquito Control Association (Berkeley): 14th annual conference 1945.
Proceedings. Ohio State Horticultural Society (Columbus, Ohio): Vol. 79 (1946).
Psyche (Boston, Mass.): Vols. 11 (1904), 13 (1906), 16 (1909).

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